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RECLAMATION OF SURFACE-MINED PRIME FARMLANDS

HEARING
BEFORE THE
SUBCOMMITTEE ON
ENERGY, NUCLEAR PROLIFERATION, AND
GOVERNMENT PROCESSES
OF THE
COMMITTEE ON
GOVERNMENTAL AFFAIRS
UNITED STATES SENATE
NINETY-SEVENTH CONGRESS
FIRST SESSION

OCTOBER 22, 1981

Printed for the use of the Committee on Governmental Affairs

U.S. GOVERNMENT PRINTING OFFICE
90-592 O WASHINGTON : 1982

S401-26

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RECLAMATION OF SURFACE-MINED PRIME FARMLANDS

THURSDAY, OCTOBER 22, 1981

U.S. Senate,
Subcommittee on Energy, Nuclear
Proliferation, and Government Processes,
Committee on Governmental Affairs,
Washington, D.C.

The subcommittee met, at 9:30 a.m., in room 3302, Dirksen Senate Office Building, Hon. Charles H. Percy (chairman of the subcommittee) presiding.

Present: Senator Percy.

Also present: Senator Dale Bumpers.

OPENING STATEMENT OF SENATOR PERCY

Senator Percy. I am pleased to call to order this hearing of the U.S. Senate Subcommittee on Energy, Nuclear Proliferation, and Government Processes.

This hearing will examine the Department of the Interior's implementation of the 1977 Surface Mining Coal and Reclamation Act, particularly the provisions regarding the reclamation of prime agricultural farmland.

My goal in this amendment, and the goal of the Congress with the overwhelming, almost unanimous, support of the amendment by the Senate, is to guarantee quality reclamation without interfering with the coal production so essential to America's—indeed the world's—energy future.

I hope at today's hearing we can discuss ways to accomplish both of these goals.

I might say, Secretary Watt, that I put 2 years as, you might say, "house rep" on the President's Commission on Coal established by President Carter with the Governor of West Virginia as the Chairman of it. Jennings Randolph was one of the most active Senators on that committee.

Our goal was simply to double coal production inside of 5 years. At no time in that Commission report did we ever ask for a release from or a change in laws on environmental standards.

What we did do was protest vigorously the attempt to, I think, take unreasonable steps which would cripple coal production which were, you might say, the optimum in a society that cared nothing about economic development, but put all of its emphasis on the environment. And we simply beat down all of these attempts to be totally impractical. But we always were balanced and had good environmental people working with us; it was always a balancing act and we determined that you could double coal production.

In fact, we are well ahead now of the estimates we made on exports alone. But we still have some problems. But with that background, I introduced this legislation to protect our prime farmland. Eighteen million acres of prime farmland in the United States does have coal under it. Of that 18 million, 9 million of it is in my State of Illinois. So for that half I had to weed my way through the coal operators, landowners, and farmers. We came up with a program which they all could live with. It wouldn't have been exactly as everyone would have liked it. But the operators, technically, said it could be met, and prices were adequate to do it. The farmers were so fearful of taking one of the greatest assets we have in earning coin exchange: One out of every two agricultural workers in Illinois is employed for agricultural exports. That program has given a tremendous amount of assurance to agricultural interests that we are not going to rip up the soil and take it out of production for growing crops.

The energy situation we face today is a grave one, as we all know. The free world must cut back on oil imports and rely more on energy available from stable sources of supply.

One of these sources, both for our own country and for the world, is our own vast domestic reserves of coal.

As chairman of this subcommittee and chairman of the Foreign Relations Committee, I am doing all I can to promote coal, especially Illinois coal, in my case, for export to markets throughout the world. We just did sign a contract with Spain which is the first contract of any European company in history for Illinois high-sulfur coal.

Spain needs it in their cement-making industry. I wish we were making more cement around the world that needed high-sulfur coal. But I think the other nations will be following because they see the vast resources available, the steady source of supply, and reasonable prices as an attractive package. At the same time, we cannot solve our energy problems at the expense of agricultural production in the years ahead.

We should be aware that many agricultural experts predict that food prices could some day be as serious as our present energy crisis. All we need to do is recognize that our President and chiefs of states of many nations are in Cancun today, worrying about the future of our developing world. Worrying about how we are going to feed the billions of people that we anticipate will populate those areas, most of which are simply unable to produce enough food for their own subsistence.

They are going to depend upon our heavy food production in the future years and we have got to look to that as one of the greatest contributions we can make toward world society.

We must also be sensitive to the situation presently facing the agricultural community. The squeeze on farmers today by high production costs, high interest rates and low farm prices should not be made worse by shortsighted resource development policies. We need balanced development of all of our Nation's resources, including energy and agriculture. I think "balance" is the right word to use.

We cannot go to the extreme one way or the other. You have got to stay balanced as we well know. That is why land once mined must be reclaimed to be available again to meet the food and fiber needs of our Nation and the world. That is why in addition to being a strong promoter of coal I have also been one of the principal supporters of quality reclamation of surface mined prime farmland. As a nation eager to ship more coal overseas with adequate coal prices, we can definitely afford quality reclamation. With Midwestern coal delivered in the Far East at roughly $80 per ton, the extra dollar or two a ton that may be required for quality reclamation should not be a major market barrier. Reclamation costs totalling just a few percentage points of the export prices is a cost we can logically expect our overseas' customers to pay. Domestically, we should face the fact that in America, utility customers, which means all of us, of course, are paying some of the cost of reclamation every time we pay an electricity bill. For this reason, we need to make sure that what we are getting is worth what we are paying. No one can put an extra price on the value of preserving the land for future generations. Certainly, it is worth the few dollars a year in our electricity bills.

Mr. Secretary, if you have been to Percy, Ill., I will notice you are one of the few people in America that ever has. [Laughter.]

It is a little area in Randolph County that my family has had absolutely nothing to do with. But I was the first Republican that ever carried Percy—it just shows what name recognition does for you—when I first ran for office in 1964. [Laughter.]

It is a town in Randolph County south of East St. Louis. If all towns in Illinois grow at the same rate as Percy, it will soon be the smallest State in the Nation. It was a coal-mining town. It is a microcosm, really, of the surface mining industry. On the one hand it is the hometown of one of the early pioneers of reclamation, Mr. Bill Mullens, who founded the Arch Minerals Corp. Arch Minerals has kept up this tradition, and one of our witnesses this morning will report on the commendable job this company is still doing today.

On the other hand, some of the land in the same part of the State reflects the past abuses which we must now avoid. These areas were surface mined at a time before reclamation was emphasized.

Now these areas around Percy are underproductive, sufficient only to support a declining population, the population being now about a third what it was at the turn of the century. Many of these people, most of them, are forced to drive over an hour each way—a 2-hour round trip—to the only job they can find up in the St. Louis area, because the area was without reclamation properly done years ago.

The area became too desolate to support employment. Congress passed the Surface Mining Act to make sure such mistakes are not repeated.

We expect to learn a great deal from our witnesses, and we have a distinguished panel this morning.

I welcome the witnesses and thank them for being here with us. I hope we can make some progress on some special issues, such as the grandfathering of existing mining operations. In the main, I would like to reassure the people of Illinois and the Nation that in our drive for greater domestic energy supplies, we will not let ourselves trade one problem for yet another.

I know that that is your policy, Mr. Secretary. And it is the policy, certainly, of the Congress.

Our first witness will be the Secretary of the Interior, Mr. James Watt. Secretary Watt, your job is an extremely difficult one requiring you to cope with very strong sentiments on both sides of many, many complex issues. I am sure that you and I agree in the main that we must find a balance between protecting our Nation's national treasures and sound resource development policies. We may not always agree about the methods to reach that goal. But I respect and I share your sense of urgency about the world's energy situation.

To the extent you can contribute to reducing our excessive reliance on imported oil, you are certainly the most important environmental protector I can think of, reducing the chances of economic environmental catastrophy which might result if the industrial world does not develop more resources and stable supplies of energy.

Today's hearing will address an environmental issue of great concern for people of Illinois, the reclamation of surface mined prime farmland. I have read the letters from the people of Illinois and there are many who are very critical of your work. I suspect many thousands of people who signed the environmentalists' petitions are some of my constituents. I hope in your testimony that you can alleviate some of the concerns that these people have, as one purpose the hearing is to get better public information right on the record, to disspell some of the myths and some of the stories that have been blown up, many of which I know are distorted and are actually fallacious.

We want to put it right on the record at this time. We are delighted to have your own testimony.

TESTIMONY OF JAMES G. WATT, SECRETARY OF THE INTERIOR, ACCOMPANIED BY JAMES R. HARRIS, DIRECTOR, OFFICE OF SURFACE MINING, DEPARTMENT OF THE INTERIOR; DEAN HUNT, ASSISTANT DIRECTOR FOR TECHNICAL SERVICES, OFFICE OF SURFACE MINING; AND DON TINDAL, ASSOCIATE SOLICITOR FOR ENERGY AND MINERALS, DEPARTMENT OF THE INTERIOR

Mr. WATT. Thank you, Senator.

I do have a prepared statement. If I might, I would like to submit that to the record and share some thoughts.

Senator PERCY. The full text will be incorporated in the record.

Mr. WATT. With me is James R. Harris, Director of the Office of Surface Mining and Dick has a statement he will give when I am through, but Dick is a new penny that we are extremely proud of and he has done a great job with the Office of Surface Mining.

First of all I want to compliment and thank you, Mr. Chairman, for calling this hearing and setting the prespective that you have. Both Dick and I have attended several hearings during the last 9 months. To my knowledge this is the very first hearing that has been called that talks about a balance between the Nation's energy needs, its environmental needs and its agricultural needs. Too frequently, as your statement points out, our political forces come together with a narrow vision and say we are going to talk about creating energy, or we are going to talk about environmental protection without the cross walk and never have I heard anybody talk about adding the third dimension of agriculture which is so critical not only to America but to the world.

So I want to thank you for seeing the greater picture. I hope that the message you are developing and the informantion you are developing will be disseminated throughout Congress so that others will see what you see in looking at the various dimesions of America's concerns.

We have a critical role to play in America, for Americans and for the world. And balance must be the theme. As we look to America's energy needs we find that America continues to import roughly 40 percent of its crude oil needs basically from the OPEC nations that are extremely explosive. We have an opportunity to reduce that dependency if we will bring about the orderly and proper development of our coal resources in America.

But that must not be done at the expense of our environment or our agricultural potential.

You have drawn our attention this morning to the meeting in Mexico where world leaders are meeting to discuss the plight of the less developed countries and the poor populations of the world. It triggers some reading that I have been doing recently from a Global 2000 report which I don't endorse in its entirety, but they make an interesting point, that over half of the people of the world are not looking for additional oil or coal. They are looking for firewood so that they can heat their homes and cook their food. As they search for firewood, the forests of the world are being destroyed.

We are suffering from the world forests' perspective. From a global perspective, the deforestation of the world or the desertification of these lands. And as these people from the less developed countries search for energy they are destroying the environment. And as the forests of the world are being lost and indeed they are, we see the erosion of the soil and the reduction of agricultural potential to feed the hungry people of the world. In fact, the Audubon Society had a magazine article come out in March that talked about the threat to the Yankee forests of the New England States, that energy costs in the New England States for heating have gone up so high that there is a pressure being put on the Yankee forests that is of serious consequence.

So while I talk about the less developed countries, we need not go that far.

As we look for hunger, these people, these poor people of the less-developed countries would love to have the opportunity to drill wells or to dedicate a few acres to coal production to heat their homes and cook their food and yet their agricultural potentials might be lessened considerably. It takes a wealthy nation to have a strong environmental concern. It takes a wealthy nation to feed the poor. That can only be done with the balance that you have spoken of in your opening statement.

That is why it is so critical, that this Nation look to the bigger vision and bring about the energy development with proper environmental concerns that will not destroy our agricultural potential.

In the Department of the Interior we have a unique and critical stewardship role to play. We have ownership and management responsibilities for one third of the land. Portions of that land have been set aside, 156 million acres have been set aside to be preserved for parks and wildlife refugees.

They are to be preserved for future generations. They are not to be used for agricultural potential nor for energy potential. As long as I am Secretary we will not drill, we will not mine, we will not cut the national parks. As I have shared with you in private, and I have asked Congress and I think Congress will respond, to increase the appropriations for restoring the parks. I have asked that the budget be doubled over what Carter-Andrus asked and for 1982, roughly a 200-percent increase because the GAO reported that our parklands will be allowed to deteriorate to such a degree that it would take $1.6 billion to restore them to their health and safety standards. That is a sad story that I have reported to the Senate Energy and Natural Resources Committee and the House Interior Committee and here.

But we have not been good stewards of the land.

Senator Percy. Could I just ask you something at that point? I am immensely pleased in the light of all of this budget cutting that you have the guts to ask for that kind of money and I wish you well with David Stockman. [Laughter.]

I might say that this committee has oversight over OMB. We have had a marvelous working relationship with him. He has helped us on any number of things when he really sees a necessity for it. But I will stand with you, and so will a lot of others stand with you, because the worst thing we can do is let the parks deteriorate. The eventual cost then with inflation to bring them back to standard is just going to be terrible.

Mr. Watt. That is correct.

Senator Percy. What has happened that has caused us to constantly do this? It is like a company cutting out research and development, and maintenance of their buildings, and show a profit for 2 or 3 years and then suddenly, you are faced with a company that is on its back. It has got no future. Where do you get the money to then rebuild? We did that with our Defense Department over a period of years. It has sickened me to see my branch of the service, the Navy, deteriorate as bad as it did.

What happened to let this deteriorate so badly when it was one of the greatest services we ever had in the Federal Government?

Mr. Watt. Your chronology is quite correct. It is true not only with the Park Service but with the wildlife refuges. I am pleased to report that the President personally as well as David Stockman and others have supported this request for an increase. Overall I asked roughly for about a 20-percent reduction in the budget of the Department of the Interior while I am asking we double or 200 percent increase for our national park restoration and we are moving in the 1983 budget to ask that moneys be focused on the wildlife refuges.

The other lands that we have responsibility for in addition to those lands—well, I didn't answer the question. The reason that that has happened in my judgment is that there was a concern that we acquire more lands for the National Park System and hundreds of millions of dollars were invested in taking private lands off the tax rolls to put in the National Park System rather than using that money to restore and take care of what we have left.

We are reversing that. But in addition to the park and refuge lands that we must be good stewards of, we have roughly 550 million acres that are to be managed for multiple purposes. That is for agricultural use, wilderness, preservation, recreation, energy, and timber. But in addition to that, those management responsibilities, we have responsibilities for seeing to it that the private lands are reclaimed and we have, as of 1977, an Office of Surface Mining that has been directed to work with 27 States to see to it that good State programs are developed for the reclamation of those surface mined lands that are actively being mined as well as the abandoned mine lands.

Dick Harris has been asked to direct that and has been confirmed by the U.S. Senate to do that job and we are in a massive undertaking because again, Mr. Chairman, good stewardship has not been followed there as it should have been. I am sure you will want to visit with Director Harris in some detail about the changes that we are bringing to the Office of Surface Mining and they are substantial. They are important and they are critical if we are to have the balance that you refer to in your statement.

The main problem that we have in reclaiming and protecting the environment of surface mined lands is not with the act. The 1977 act is a good act. We are asking for no amendments. We are asking for no changes. We think it is good and we will see that it is properly implemented and enforced and are doing so in an aggressive manner. We are working with the Governors of the 27 States to do that. I think I can state without fear of contradiction, that we have the support of every Governor of every State dealing with the Office of Surface Mining.

We have outlined major changes in the regulations that have been implemented by the Department of the Interior with regard to the 1977 act. The changes that we are bringing about have been supported by the Governors without major exception and I don't think with any exception, in spite of the rhetoric that you referred to in your opening statement. We have full support. The National Academy of Sciences has endorsed totally what we are trying to do to change those regulations in spite of the rhetoric to which you have referred.

The National Academy of Sciences has complimented us highly on this because we are seeking to change those regulations that have been implemented in the past since 1977. Because the regulations were written for design standards rather than for performance standards, they were requiring that a coal operation in West Virginia function the same in designing that mining operation as it would in Indiana or in Illinios or in my home State of Wyoming.

Any man who understands natural resources, any man who understands the environment, knows that that is a ridiculous requirement and that is why Dick Harris and his people are changing it. That is why the Academy of Sciences has endorsed it and that is why the Governors have been so enthusiastic in encouraging us to bring about the change. It will make the regulations of the Department of the Interior consistent with the act as Congress passed it rather than some blown up contorted thing that distorts the ability to bring about agriculture, environmental and energy needs.

So we have a stewardship responsibility. We are addressing it. I am pleased to report to you that we have received enthusiastic support from the Governors on coal mining activities.

We received 100-percent endorsement from the 12 Western Governors that participated in the Western Governors Conference on every change that we are bringing into being.

The congressional committees have been very supportive, and the polls, the Gallup polls and our private polls, indicate the majority of the people support by, I believe 78 percent, the changes that we are bringing to make the balance a reality. I am pleased with the progress that we had, and particularly delighted again, Mr. Chairman, that you have put this issue in its perspective so that we are not just looking at energy development or not just looking at the need to protect the environment or the need to have agricultural capability in America. But these interrelate. I think you have charted with your opening statement in this hearing an opportunity for dialog and understanding that will hopefully enhance better communications with public and private, Federal and State, federal and private, to make those things happen.

I am eager to submit myself to your questioning, and Senator Bumpers', and hopefully we can address some of these issues that are important to making America great again.

Our theme has been to restore America to her greatness as we bring about the changes.

A nation's greatness, Mr. Chairman, as you well know, the greatness of a nation is determined on how that nation manages its human resources, and how it manages its natural resources. We have not done well in managing our resources. That is why we are bringing about the change to restore America to her greatness. Every decision we make with regard to these resources, the one-third of the land that we manage, as well as the 1 billion acres of OCS lands is made with three criteria: One, will that decision improve the national defense? two, will it protect the environment? and, three, will it create jobs? You have put this in a perspective that allows that criteria to be measured as we try to restore America to her greatness and better management of natural resources.

Thank you for this opportunity and I submit myself; if I get in trouble, I will turn to Dick.

Senator PERCY. Fine. Thank you very much.

Mr. Harris, you are able to stay on, aren't you?

Mr. HARRIS. Yes.

Senator PERCY. We have had a good talk together and I have some questions for you. I know Secretary Watt has a departure time that coincides exactly with Senator Bumpers', who must also leave at 10:30. I would like, at this time, to first welcome Senator Bumpers, who is not a member of this committee, but he is a powerful and influential member of the Energy and Natural Resources Committee, and is one of the outstanding experts in prime farmland.

With all due deference to our Western Governors and Western Senators, I will send to you the colloquy I had on the floor with Clif Hansen when he was a Senator, trying to explain to him what I really meant by prime farmland. He just couldn't understand what was the distinction. What is prime farmland? I gave it to him in all the technical detail, all the chemical analyses, land, and so forth, and just finally said, "Look, you know it is prime farmland in Illinois if it is selling for $4,000 an acre or more. There is a big difference."

Senator Bumpers, I would like to yield to you for any opening comments that you would like to make, and then I suggest we each just take 10 minutes of questioning.

That will just about do it.

Senator BUMPERS. Mr. Chairman, I will be willing to forgo an opening statement, and let Mr. Harris go ahead so perhaps we can question both of them before Secretary Watt has to leave, if you think that is possible under the time constraints.

Senator PERCY. I rather thought that Mr. Harris could stay on. We will let the Secretary leave and both of us question him.

Senator BUMPERS. Fine.

Mr. Chairman, with that——

Senator PERCY. I yield to you to question him first.

OPENING STATEMENT OF SENATOR BUMPERS

Senator BUMPERS. Let me say, first of all, I appreciate very much your allowing me to participate in this.

As you have correctly stated, prime farmland has been an item of great interest to me. I know you will recall that when we were trying to hammer out the surface mining bill, farmland preservation was a very sticky point.

The Department of Agriculture has come out with some alarming figures in the last few years as have other persons who study our domestic food needs and global food needs.

For example, Allen Hildenbal said that we anticipate a total of 3.2 million acres of prime farmland being lost in Iowa, Illinois, Indiana, Ohio, and Missouri by the year 2000 if the present trends continue. It was that figure, of course, that really alarmed me, but every day, light now in this country, we are taking 4 square miles of prime farmland out of cultivation and shifting it to other purposes.

My primary concern, Mr. Secretary, is that you have alluded many times here to returning this country to its greatness. As a general statement I think we all applaud that, but if we are not able to feed ourselves, by the year 2000, we are not going to be very great. While I can understand, and I share the chairman's enthusiasm for coal production, I think he also said in his opening statement that there has to be a balance. I think the prime farmlands provision of the surface mining law is the most important part of it.

I would also like to say that I do not see the necessity of West Virginia complying with the same rules, for example, that Illinois and Indiana must comply with. They are two entirely different topographical and geographical areas.

But that is one of the reasons we allowed the States to develop their own plans, so that that could be taken into consideration in the regulations.

Senator Ford tells me that down in West Virginia and Kentucky they had 70-yard football fields on the tops of some of the mountains. I know that that terrain down there is very difficult. I wouldn't suggest for a moment that every coal operator in the country had to abide by the same rules. But I do want to just say, so that you can be thinking about it for the question period, that I am concerned about the removal of the cutoff date for the grandfather clause which exempts operators who were operating and had permits at the time the surface mining bill was passed in 1977.

I am concerned about removing that date of August 1982. Surely there has to come a time when operators start complying with this bill; otherwise, the grandfather clause just renders the law useless.

I am concerned about whether or not you are in a new rulemaking posture right now, and if so, how soon you expect to come to a conclusion on when exemptions under the grandfather clause will come to an end.

The second point that concerns me is that under the previous regulation, land used in agricultural production for 5 out of the last 20 years was to be considered prime farmland. Senator Percy again has raised an issue that was very difficult for all of us and that was definition of prime farmlands. Under your new regulation, or at least under the new proposed regulations, lands that have been used for agricultural purposes for 5 of the last 10 years will be considered prime farmland.

Those are the two things that I really am here to discuss this morning.

Senator PERCY. Thank you, Senator Bumpers.

Mr. HARRIS. Senator Bumpers, I will get into that in some depth later in the testimony.

Senator PERCY. Very good. Fine.

Mr. Secretary, first let me talk about the concern that has been flooding in on me and I think other Members of the Congress about what they perceive to be the tendency of your Department, and tendency of the Reagan administration to tip the scales too much in favor of energy and other resource development at the expense of the environment.

To a large extent, I supported the increased development of domestic resources, solidly supported those programs, but we do realize that balance has to be taken into account. I know in private conversations I have been reassured on this point.

At this time in the public hearing I wonder if you could identify a case or two where you feel the environmental tradeoffs are too steep; that is, where we stand to gain too little by way of energy supplies with too much of a risk to the environment, and then turning the coin to the other side, what is the opposite example or two that might come to mind where the potential energy benefits are very large and the environmental risks relatively small.

Obviously, any of these questions that you want to supplement for the record you can certainly do so. We will keep the record open for that purpose.

Mr. WATT. Senator, first of all, we don't approach resource management in an either/or context. We are satisfied that we have the technological capability and the managerial capability to have both environmental protection and energy development.

We think we can protect the environment and create jobs. I come from the Western part of the United States and I find myself apologizing for that to many of the Senators. Senator Bumpers, I have had to apologize to for that repeatedly. But somebody has to come from somewhere. I come from the Rocky Mountain West. In those Western States and in the public lands, let me speak to the public lands. In the public lands that I have responsibility for managing we have the potential for 85 percent of the crude oil, 40 percent of the natural gas that will come, 80 percent of the oil shale will come from these public lands; 35 percent of the coal of America. We have tremendous quantities of energy. The question is not whether these energy resources will be developed for America. They will be.

Two questions remain. How will they be developed, and when will they be developed? I believe that it is important that we allow the development of these energy resources on public lands in an orderly, phased manner with proper environmental concern so that we can meet the energy needs of Chicago and Little Rock which take a lot of our coal from these Western States as well as the other Western States on the west coast, and other mid-America cities.

We need to start bringing that on to meet America's needs. If we do not bring on an orderly phased environmentally sensitive developed program for these energies that belong to American people, they do not belong to the State, they belong to the taxpayers of America, if we do not bring it on in an orderly phased manner, we will see a political economic crisis grow that will further pit East versus West and we already see it in the severance tax issue that Senator Bumpers has talked to me about before, in the have versus the have-not energy States.

That economic political battle will erupt to such a degree that I genuinely fear that the political pressures could grow, that the Government in Washington, D.C., might say we will take that energy from our public lands under a crash environment crisis environment that will do damage, severe damage to the ecology of the West, as well as to the lifestyle of the West. I think to America as a whole, because there would always be the forces that would come to bear to say the private sector has failed to do it, we must now nationalize those energy industries.

I detest the thought of both of those concerns that I fear. So I do not view this as an either/or thing. I think it is the responsibility of the stewardship that we start bringing those along.

The law is very clear, that in our national parks there will not be mining, drilling or cutting. I think those are sacred areas that must be kept that way. I know in the literature that you have read from some of my critics that they say something else. But at my confirmation hearings, at which Senator Bumpers attended and grilled me aggressively and properly, I testified then that we would not. I have repeatedly said that. I have said it without reservation and yet the critics will refuse to look to the truth. Those lands are not open, the parks will be preserved. I think there are five exceptions to that.

Congress has allowed mining activities, I think the number is five, that are a very limited number of recreation areas. Secretary Andrews was subject to a lawsuit and the Department of the Interior lost that lawsuit and now I am under a court order of the Secretary Andrus lawsuit to make regulations for mining activities in those recreation areas.

I will have to comply with the law. I will have to comply with the court order because the recreation areas are not parks. I am telling you this in the public record because the hue and cry will soon be that Watt is trying to destroy the park system. I will not do that. The law clearly prohibits it. I would not want to, and I have testified repeatedly to that.

We are the ones that are asking Congress to double the budget to restore the park system because it was allowed to deteroiate in the last several years, and it is not just the last 4 years. It is the last several years that it has been allowed to deteriorate. Those areas should be set aside and never be subject to mining or drilling activity.

On the other hand, you asked for the other extreme and you always get into trouble talking about extremes. So you have asked me to walk on thin ice. But I will risk doing so.

Senator **Percy**. That is no different than the thin ice we keep walking on 24 hours a day, 7 days a week.

Mr. **Watt**. We have some lands in my home State that are on the eastern part of the Powder River basin. To those of us who grew up there, it has a unique beauty. But it is a cold desert area and I think America wins if we sacrifice the few acres that are needed to mine those wealthy seams of coal, 70 and 100 feet deep, 3 feet under the top, to meet the electrical needs of Minneapolis, Chicago, St. Louis and mid-America, as well as the coast, and our sparsely populated West.

The land can be reclaimed. There is the sacrifice of those few acres as you roll through the surface mined area and reclaim it.

We have changed some regulations so that we can improve. We get abused on everthing we do. But we are allowing the lands to be reclaimed better than nature. We have received abuse on that because some people want it to be restored to its natural state, but when you look at the grazing potential, the wildlife potential, why can't we improve the grasslands on those mined areas? We think we should. We are moving that way.

Senator Bumpers referred in his opening comments to some 70-yard football fields. I just recently have been touring that area to learn about what a steep slope is and what a high wall is. I am still learning obviously. I did not know what a high wall was until I went into that country. But it looked to me like everything was too steep to build on or on flood plain. In my judgment the practical answer would be that you would allow some of the lands to be left flat so you could have a football field, or housing development, or a hospital or shopping center or community activity. But the law prohibits that. We are not asking the Congress to change that law.

We hope to use some commonsense under section 711 to allow some experimentation on that, but the law does not permit, to use the Senator Ford story, the 100-yard football fields. I do not think that is good commonsense. But I am not opening that fight up. We are going to live with the law as it is because I think you can improve wildlife habitat. I think you can improve grazing lands.

Senator **Bumpers**. If I could interrupt you, the greatest cartoonist I've ever seen in my life is with the Arkansas Gazette. He is always after the Corps of Engineers because they always want to channelize every stream and dam every river. In one cartoon the corps was overlooking the valley below and there was nothing but smokestacks and cut timber and that sort of thing down below.

One of the men turns to the other one and says, "That is the way God would have done it if he had the money." [Laughter.]

Senator PERCY. Mr. Secretary, I just have——

Mr. WATT. Excuse me for going on for a long answer.

Senator PERCY. Two or three quick questions, and they can be short answers. You can supplement the record for them. I would like to say you used the term "sacred," however. There are certain things that are sacred. And we have got a lot of fine members of the press here. I hope they will accurately report and I am sure they will, what you have said, because what you have claimed is an extraordinarily important statement of policy by this administration. But I just put a bill in yesterday—or the day before, for disposal of surplus unused, unneeded, Government assets which total over a trillion dollars.

We are just sitting on these assets; doing nothing with them. But I totally excluded the Park Service, all of that. I just lived in fear that I would see a headline, "Percy Wants To Sell Off the National Parks," or something like that.

When you mentioned certain sacred areas, and I am looking out now at some of the leadership of the American Farm Bureau, and the Illinois Agricultural Association in our audience this morning, where would you put surface mining, especially surface mining on prime farmland, in the spectrum of your comments, as to the importance of preserving that for the future?

Mr. WATT. If those lands cannot be restored to their productive capacity, then I doubt, I don't think they can be under the law.

We have got to be able to feed ourselves and the world. It takes a wealthy, strong nation to feed the poor. It takes a wealthy, strong nation to take care of its environment and the environment of the others.

I think America's greatness, strength needs to be preserved and that includes agricultural farmland.

Senator PERCY. We have mentioned giving States the authority, and generally I support giving States more authority, over social and regulatory programs. For example, in Illinois with our vast resources of prime agricultural land we know more, really, about the reclamation of surfaced mine land than most people in Washington or in other States with less farming or less mining.

However, one problem with leaving so much to State-by-State discretion is that in a time of slow economic growth, States may be tempted to compete with one another to sacrifice environmental goals in an all-out competition to get jobs.

Is there anything your Department can do to address this particular problem, which has been a national problem?

Mr. WATT. Yes; I think Congress did address that wisely in the Surface Mining Act of 1977. They wanted primacy to be given to the State, but to prohibit the occurrence of what you have expressed fear of from happening, they have required that the Secretary of the Interior through the OSM, maintain vigilant supervision over those State programs so that the reclamation programs would not be sacrificed for economic activity and if the State does attempt to do so, then the Federal Government is triggered back into the enforcement responsibilities. We will honor that legal requirement. We think it is a wise one.

Senator PERCY. My last question, then, does get back again to the grandfathering exemption of the prime farmland reclamation provision, and I will later address to Director Harris a number of questions in that area. But with your presence here, I again would like to repeat that I did propose the prime farmland reclamation amendment, Public Law 95–87, as there is no State more affected by this issue than Illinois.

One-half of the prime farmland with coal under it is in Illinios. In my opening statement I expressed my concern, as you have, about both energy resource development and protecting our Nation's environmental quality. Can we have an understanding between us on this act that was carried virtually unanimous—I think one vote against it possibly–can we have an understanding between us that you will, to the best of you ability, carry out the spirit and objective of the 1977 act consistent with the intent of Congress in enacting it?

Mr. WATT. Absolutely.

Senator PERCY. As the sponsor of this amendment, Director Harris and you can call me at any time if you ever have any questions about the intent of the Congress. Senator Bumpers and I worked intimately on this. We know the thinking of every single Senator who worked on it and the intent of Congress is very clear. We would be very happy to interpret that, pull out the legislative history on it, and give you the benefit of our views.

Thank you very much indeed.

Senator Bumpers?

Senator BUMPERS. Mr. Secretary, I will just pursue a little bit of what Senator Percy has asked you.

Why was the original cutoff deadline of August 1982 for coming into compliance under the grandfather clause lifted?

Mr. WATT. I don't believe it has been.

Mr. HARRIS. Senator Bumpers, we will get into that in a great deal of depth and give you a complete calendar on what we intend to do with that regulation, and I think to your satisfaction, a little later.

Senator BUMPERS. How many State plans have been approved thus far?

Mr. HARRIS. There are 17, I believe, with either complete approval or conditional approval.

Mr. WATT. Out of 27.

Senator BUMPERS. How many States mine coal?

Mr. HARRIS. Somewhere in the neighborhood of 25 to 27.

Senator BUMPERS. Most of them that are going to be in the busiiness of mining coal have been approved?

Mr. HARRIS. You have to look at it two different ways.

Most of the large number of States have been approved but the States with the most inspectable facilities yet lack approval. Most of the approved programs are in the West and the States that have approved programs have about 18 percent of the inspectable facilities. Those without approval will have about 80 percent of the inspectable facilities.

Senator BUMPERS. Has Indiana's plan been approved?

Mr. HARRIS. Yes. It has conditionally.

Senator BUMPERS. Has Illinois?

Mr. HARRIS. No.

Senator BUMPERS. What is the status of the Illinois project?

Mr. HARRIS. The Illinois program will be resubmitted sometime between now and the end of the year.

Senator BUMPERS. What was wrong with the one submitted originally?

Mr. HARRIS. It was enjoined in the courts as provided in the act for a 1-year period. Then the industry enjoined the State from promulgating regulations for a 1-year period as provided in the act.

Senator BUMPERS. Most of my questions really would be directed toward Mr. Harris, who has not yet testified, and may cover a lot of the answers to questions I have. So I will stop here.

Senator PERCY. Thank you, Mr. Secretary.

We are 2 minutes ahead of schedule. The record will be kept open, however, because there are Senators on the committee, some of whom are on the floor now, that may be submitting questions and we will keep it open for that purpose.

We thank you very much indeed.

Mr. WATT. Thank you, Mr. Chairman. It is a delight. Let me again compliment you for seeing the environmental energy and agricultural interrelationships we wrestle with today.

I appreciate your putting that in perspective.

Thank you very much.

Senator PERCY. We enjoy working with you, and I look forward to a closer relationship.

Thank you.

I want to thank, by the way, your staff, who has been extraordinarily cooperative in working with us.

Director Harris, I look upon you as a very knowledgeable man in this field, one that we have developed some colloquy with immediately, and you understand the intricacies of coal production and surface mining issues.

You were chairman of the Indiana Senate Committee on Natural Resources, Agricultural and Environment. You chaired a committee of the legislature to draft the 1977 Federal surface mining laws into the Indiana law. During your last full term in the Indiana Senate, your voting record was rated 100 percent for the Isaac Walton League. So you are a valuable man, filling a position of controversy, particularly at this particular time, and we look forward to your testimony. Both Senator Bumpers and I welcome you.

Mr. HARRIS. Thank you, Mr. Chairman.

I have a prepared statement that is rather short. I would like permission to read it into the record.

Senator PERCY. Please.

Mr. HARRIS. Mr. Chairman, distinguished members of the committee. We of the Office of Surface Mining consider it a privilege to appear here today to listen to testimony with regard to the protection of our Nation's prime farmlands under Public Law 95-87.

Today I am here, as you are, on a factfinding mission. Thus I will keep my remarks brief so that we can have full opportunity to listen to the testimony of today's witnesses.

Senator, as I am sure you are aware, the Office of Surface Mining is currently involved in a regulatory reform effort of the Federal regulations for surface coal mining and reclamation. The plan for the OSM regulatory reform has been designed to accomplish the following primary objectives:

Remove excessive Federal regulations;

Return primary responsibility for surface coal mining and reclamation regulation to the States;

Provide cost-effective regulation;

Provide minimum regulatory authority involvement in the development and design of mining operations;

Assure continuity of State program regulation necessary to maintain coal productivity and provide environmental protection; and

Provide technical guidance and leadership to States.

Within this general framework, three distinct rulemakings have been identified with respect to special prime farmland regulations. These rulemakings are related to:

One. The historical use clause;

Two. The grandfather exemption; and

Three. The special performance standards for prime farmlands. The first two were rules reviewed under the President's memorandum of January 29, 1981, and Executive Order 12291. After opportunity for public comment and after making revisions where appropriate, I recently issued revised final rules in these two areas.

The historical use rule defines those prime farmlands that are "historically used for cropland." The changes resulted from decisions of the U.S. District Court for the District of Columbia and the need to eliminate inconsistencies between interim and permanent program regulations.

Senator Bumpers, I believe that statement can very well be an answer to the question that you asked earlier.

Briefly, the historical use rule, which was published in the Federal Register on September 28, 1981, accomplished the following: One, defined "historically used for cropland" as 5 out of 10 years; two, measured the historical period from the date of acquisition of the land for mining purposes; three, provided flexibility for the regulatory authority to classify as prime farmlands those lands important to the State or local economy; four, provided flexibility for the regulatory authority to classify as prime farmland those lands taken out of cropland use for more than 5 years in 10 due to ownership circumstances which do not relate to the capability of the land to produce crops; and five, substituted the term "cropland" for "cultivated crops."

The second rule involves the grandfather exemption. Under section 510(a)(2) SMCRA provides an exemption or "grandfather clause" from the prime farmland provisions for any permit issued prior to the date of enactment of the act or to any revisions or renewals thereof, or to any existing surface mining operations for which a permit was issued prior to the date of enactment of the act.

The primary issue in interpreting this exemption has been the question of whether the act allows an exemption for areas of ongoing mines that were not covered by State permits prior to August 3, 1977, and, if so, how extensive an area could be exempt. In litigation over the interim program rules, the U.S. Court of Appeals made it clear that States may extend the grandfather exemption beyond the actual, pre-1977 permit area.

The final rule clarifies and provides a reasonable limit on the scope of the exemption. The new rules allow the continuation of mines on all lands that were included in pre-August 3, 1977, permits and all revisions and renewals of these permits.

They also allow the continuation of preexisting mines on lands which are first, an extension of a continuous mining pit or pits; second, part of a single permitted operation; and third, part of a continuous recoverable coal seam.

Further, the operator must demonstrate that he had the legal right to mine the lands prior to August 3, 1977, through ownership, contract, or lease. Options to buy, lease or contract for the property are not sufficient.

Considerable controversy exists with respect to a concept included in a proposal of the past administration that would have cut off the grandfather exemption in 1982. I took the action of deleting this termination date in the rule I allowed to go final only after careful consideration of the legal history of the act and the public comments received.

I appreciate the opportunity to appear before this committee today and bring this issue to your attention and to the attention of the people that will be testifying today. In a Federal Register notice issued on September 29, 1981, I specifically requested comments from persons desiring additional consideration of a rule which would further limit the grandfather exemption. In the meantime, I will work with States to provide such a provision within State regulatory programs if the States so desire.

I would like to point out that grandfathered operations remain subject to all other performance standards of SMCRA, including those relating to topsoil, revegetation, postmining land use and bonding.

To give you an example of the scope of these other rules, I have taken the liberty of pulling out pages of special standards applicable to prime farmlands, including nearly four pages of permitting requirements and just over one page of performance standards.

The significance of this can be seen by comparison to the nearly 150 pages of the permanent program regulations remaining, which will continue to apply to these mines. Thus, I reject any claim that failure to provide a termination date will destroy thousands of acres of prime farmland. Such claims merely ignore the facts involved. I believe it is better in this case to step back and provide additional opportunity for public input into this rulemaking procedure.

Clearly, there is adequate time for such reflection and ample time for an orderly procedure and opportunity for States to amend their programs to take the recent finalized rule and any future rules into consideration in the development of their programs.

General revisions of the performance standards for prime farmlands are proceeding in accordance with a regulatory reform agenda, which I have delayed so that we may have an opportunity to review today's testimony before proceeding with the proposed rule.

Draft revisions were made available to the States and the public by my staff on July 1, 1981. We have since received numerous comments from the States and other interested parties. Upon completion of today's hearing, I expect to complete any additional changes necessary in the proposal and formally issue a proposed rule for comment in the near future.

In conducting this review, it is important for all of us to put the issues involved in perspective. The total amount of prime farmland in the United States today amounts to about 346 million acres.

Of this area, about 29 million acres have been used for "intensive agricultural purposes" and are found in counties with strippable coal reserves. These reserves account for over 14 billion tons of coal. Based upon the Department of Energy's National Energy Plan, about 127,000 acres of this "prime cropland" is projected to be disturbed by surface coal mining during the next 20 years. That is, less than four one-thousandths of the farmlands in the Nation are projected to be temporarily diverted from farmland by surface coal mining during the next decade.

I would repeat that, sir, that less than four one-thousandths of the prime farmland of the Nation are projected to be temporarily diverted from farmland by surface coal mining during the next decade.

Last year, 3,000 acres were temporarily taken out of prime farmland use for coal purposes. Contrast this with the fact that approximately 1 million acres of prime farmland are permanently diverted from prime farmland each year by urbanization—812,000 acres—and water coverage—188,000 acres.

A recent, August 1981, publication of the U.S. Department of Agriculture, Economic Research Service, entitled "Coal Development in Rural America" concludes:

> Relatively little farmland will likely be disturbed by the increased surface mining of coal, and any loss in agricultural production because of mining would not be serious nationally or regionally.
>
> Potential losses in farm income resulting from increased strip mining are estimated at $16 million annually for the six U.S. Coal Production Regions—less than 0.2 percent of the $11 billion farm income from these regions.

I would like to submit the publication of the U.S. Department of Agriculture Economic Research Service that I have alluded to here for the record, Mr. Chairman.[1]

I quote these statistics not to underestimate the scope of the problem but rather to give you some guidance in evaluating the problem. I hope through our regulatory reform effort to sort out the emotional issues from the legal and technical issues and to bring forth a truly workable and effective rule.

Like you, Mr. Chairman, I am concerned about the Nation's prime farmland. I recognize your concerns and respect your work in the conference committee to have those concerns addressed in the prime farmland sections of SMCRA.

I intend to fully commit the OSM to assuring that mining is conducted in a manner that assures proper protection for these important resources. There have been numerous rumors and allegations about what the OSM intends to do with respect to the regulations for surface coal mining and reclamation. I would like to lay a couple of these rumors to rest.

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[1] See p. 314.

One of the rumors has been that I will lower the productivity requirements for reclamation of prime farmlands. I want to assure you that through our regulatory reform efforts we will continue to comply with all existing requirements of Public Law 95–87, requiring equivalent levels of soil productivity on all prime farmlands as exist on nonmined prime farmlands in the surrounding area and requiring that operators comply fully with special environmental protection standards for soil handling and restoration during mining.

Beyond these general proscriptions, sorting out the varying legal interpretations is not proving to be a simple task. Even one Federal district court judge in two different opinions has given us apparently conflicting directions; first limiting the Office's ability to require an operator to engage in farming to reclaim prime farmlands and then specifying in a later opinion that prime farmlands be reclaimed to cropland.

A paucity of legislative history on the matter further complicates our efforts. The regulations of the previous administration have been mired in litigation for years on these standards.

I hope that I can avoid some of these pitfalls in future rulemakings. To do this, I will need your assistance and the assistance of the other people who will testify today and who will submit comments to the OSM on our proposals.

This interaction and mutual interpretation of the act's requirements is essential to our regulatory reform effort, and I appreciate the opportunity to appear here today to listen to the testimony before your committee. Because of the importance of these issues, I intend to remain here throughout the day so that I may personally hear all testimony before your committee.

Mr. Chairman, again I appreciate the opportunity to be here and look forward to working with you and the other committee members over the months ahead.

Senator PERCY. Thank you, very much, Director Harris.

Your statement is helpful. But let me get right to the heart of some real concerns that have been expressed. OSM seems to be making a change in the interpretation of the surface mining law concerning the date after which grandfather exemptions on the prime farm land reclamation requirements will no longer be granted. The most recent statement on this issue appears in the September 29 Federal Register notice, which with little explanation defers the decision about a cutoff date. The date is now to be determined through a rulemaking process. This has led many of the critics to believe that OSM is going to endlessly analyze the issue and really never issue a cutoff date.

What does the Department hope to gain by once again delaying a decision on the cutoff date?

Mr. HARRIS. Sir, that rule went forward as a part, I believe, of some midnight rulemaking by the previous administration. Nowhere in the legislative history of this act does the Congress give the Office of Surface Mining reason to set a cutoff date. However, this is not to say that we will not have a cutoff date. I have with me Mr. Dean Hunt, who is our Assistant Director for Technical Services and I would like to call him forward at this time to give you our schedule and our reasoning for this action.

Senator PERCY. Yes, of course. We would be happy to have him join us.

Would you want to comment, then, on this point.

Mr. HUNT. Certainly, Senator.

We have carefully reviewed the administrative history of that particular cutoff date and have found a large amount of controversy with respect to the particular issue.

We did not feel that these issues were adequately aired in the rulemaking of the previous administration. Additionally, there has been considerable confusion with respect to the interpretation of that particular cutoff date. One interpretation would say that the grandfather exemption expires on all mines in August 1982 the other interpretation would say that the grandfather exemption expires only on nonpermitted mines in August 1982.

After reviewing the legislative history, we see one of the reasons for the grandfather exemption was to avoid the constitutional taking issues that would be raised, or that could potentially be raised, with respect to those provisions of prime farmland.

One of the problems with the interpretation that would say that those farmlands that were grandfathered under the 1977 act would no longer be grandfathered after 1982—that is, the mining operations would no longer be able to apply that grandfather provision—is those fifth amendment issues. So we have some difficulties with that particular interpretation.

Another interpretation of that particular rule would have said that no new permits could be issued, including the grandfather clause after the August 1982 date. This interpretation apparently avoids some of the fifth amendment issues that we are concerned about.

The problem is there are varying interpretations and we would like to clear those up. Additionally, the administrative record that we had was created by the prior administration and did not adequately clear up those differing interpretations.

As Director Harris said in his initial talk, we do not feel that the elimination of this particular provision at this time raises the specter of rampant abuse in your State or any other State with respect to the reclamation of farmlands. We have had stringent regulations that apply to these operations whether they be prime farmlands or not, as you know, from your history working with the act.

Additionally, reviewing the history of this particular provision, the mine operators are not totally in the dark on what is going on here. What has happened in the recent past is about 1 year ago we had about 5,000 acres of land in Illinois that were permitted under the grandfather exemption.

During the past year, we have had permits issued now for about 28,000 acres of land that would qualify under the grandfather exemption. About 13,000 of those acres actually are prime farmlands.

What we feel has happened is that the mine operators have seen that differing interpretations and based upon an interpretation that would say they had to have the mines permitted prior to August 1982, naturally they have gone ahead and gotten everything that would ever qualify under the grandfather exemption permitted so that they would be able to qualify within that cutoff date.

This is further clarified by the fact that we are now mining, disturbing about 3,000 acres of prime farmland each year for temporary diversion to mining uses.

If you take the 28,000 acres, then we have about 9 years of mining that would be permitted under this particular standard. Of course, even under the DOE estimates, we have got 127,000 acres total that could be potentially affected by strip mining and so we are talking about approximately one-fifth of that amount; less than one-fifth of that amount could be grandfathered.

Senator PERCY. Thank you, very much.

I would like all the future witnesses to take note of the comments that have been made. From the upcoming panel I would appreciate comments on the OSM interpretation of the judicial and rulemaking actions.

I want to get back to Mr. Harris. Thank you very kindly.

Mr. HARRIS. Senator, there is one bit more information I would like to give you on that particular item. We have a rulemaking calendar for republication of the prime farmlands rule. We are going for a final rule after the public comment we have asked for as of July of 1982, which would have the rule final before that August cutoff date. This has been done intentionally so that no damage is done during a period in which there is no specific addressing of a final date on the prime farmland situation.

[The information follows:]

PRIME FARMLAND—CUTOFF OF GRANDFATHER EXEMPTION

Tracking steps	Actual	Target
1. 1st draft (team)		
2. HQ Federal Register format		
3. To associate SOL and economic/environmental analysis		
4. Associate SOL comments due		
5. 2d draft		
6. To States for review		
7. State comments due		
8. Meeting with States		
9. Determination of effects/environmental assessment		
10. Assistant Secretary approval		
11. Development of proposed rule draft and analyses		Nov. 6, 1981.
12. Assistant Secretary and SOL approval		Nov. 18, 1981.
13. Transmit to OMB with draft analyses		Nov. 23, 1981.
14. OMB review (60 or 10 days)		Dec. 7, 1981.
15. Publication of proposed rule		Dec. 10, 1981.
16. Public comment (60 or 30 days)		Feb. 10, 1982.
17. Development of final rule and analyses		Apr. 12, 1982.
18. Assistant Secretary and SOL approval		Apr. 22, 1982.
19. Transmit to OMB with final analyses		Apr. 28, 1982.
20. OMB review (30 or 10 days)		May 28, 1982.
21. Publication of final rule and analyses		June 3, 1982.
22. Effective date		July 3, 1982.

Senator PERCY. Mr. Harris, let me start off. Given the continuous nature of the Illinois basin coal seams, coal companies could and have continued to mine the same seams for decades. Such operations through extensions and renewals of existing permits could go on indefinitely, never having to comply with the prime farmland reclamations provisions through the grandfathering exemptions.

As you study the provision, do you believe such a scenario is in keeping with the congressional intent of the surface mining laws?

Mr. HARRIS. No, sir. In my statement, I made it very clear that the only lands that could be included under the rule that we published recently would be those lands on which they had actual ownership at the time of the passage of the act; or lands on which they had active leases. And this does not include options or contracts or anything of that sort that they might have acquired even prior to that time.

We are only talking about lands actually under ownership or under lease at that time. So that would preclude these other endless extensions.

Senator **PERCY**. I think we can demonstrate conclusively that Congress never intended all mines existing as of August 1977, when the act was passed, to be grandfathered indefinitely. The previous administration proposed a cutoff of 5 years after the law was enacted. The same date was approved in the last Congress by 81 to 4 vote on an amendment I sponsored to a bill which never became law simply due to House inaction.

Could you give us again as definite and as firm a cutoff date as possible, and a commitment to issue such a date in the reasonable future?

Mr. **HARRIS**. The reason that we requested comment in this rulemaking was in order to develop the best information from all interested parties on what the final definition of this problem should be.

I can assure you that we will review all of that comment, take into consideration the legislative history on the act and come forward with a rule that does address this prior to the August 2 cutoff date.

Senator **PERCY**. Again, from the standpoint of the fact that we both have the benefit of practical backgrounds, to achieve the difficult we don't want to waste a lot of time on the impossible.

In 1977, the Carter administration was considering a moratorium on surface mining on prime farmland. At that time, the coal industries were claiming that 100 percent reclamation was possible, they just needed a chance to demonstrate its feasibility.

Now, there is discussion that 100-percent reclamation may not be attainable in all areas of possible surface mining. If this is true, I feel we should make an effort to encourage surface mining in those areas where complete reclamation is possible while continuing research into how to achieve complete reclamation for all areas. That would then clearly distinguish what is possible and where we simply need more research and development in order to make it possible.

Do you agree with that procedure?

Mr. **HARRIS**. I couldn't agree more. I do.

Senator **PERCY**. I have been concerned to learn that OSM's mining institutes and research centers, which have encouraged advances of new reclamation technologies may be transferred from OSM's budget or possibly terminated altogether. Without these research institutes, how does OSM plan to promote research into improved or innovative reclamation techniques?

Mr. **HARRIS**. Sir, the Mineral and Mining Institutes, of course, were a part of the 1977 act. I think they have made a sizeable contribution already. I think it was the administration's belief that the program had gotten well underway and that it could be financed from the private sector since $11 out of the $12 now going into the Mining and Minerals Research Institutes are dollars from the private sector.

The Senate has seen fit to restore the Mining Minerals Research Institutes to the budget. They have also seen fit to change that responsibility from the Office of Surface Mining to the Bureau of Mines. That is a change I do not completely agree with. I feel that the Mining and Minerals Research Institutes function very well under the Office of Surface Mining. I have a fear that they might get lost in the many other programs of the Bureau of Mines.

Senator PERCY. Just a question on organization and personnel. Under the current OSM organizational structure, OSM technical support and enforcement staff will be headquartered much further from the prime farmlands of Illinois than they have been in the past. How does OSM plan to supply these support services needed by States such as Illinois with OSM personnel operating in the Far West and Pennsylvania in the East?

Mr. HARRIS. We will have available in the Springfield office, the State office that we envision as a result of the reorganization of several people who are somewhat double trained and can give technical assistance. We will have available in the two technical service centers a broader spectrum of technical resources than has ever been available through OSM before.

In studying the cost effectiveness of the reorganization we found that we could justify the two technical services centers, one in the East and one in the West.

We did not find justification for a third technical center. If we find that to be necessary in the future, I won't hestitate to make a change in that organization. However, I think that those areas can be well served out of the two offices that we anticipate organizing at this point.

Senator PERCY. For my last question, I need to refer to this map up here. I agree with you that on a national aggregate level, the number of acres of prime farmland lost to urbanization and other reasons is much greater than that due to surface mining.

I can assure you that every time a new shopping center, every time a new highway, every time a new airport goes into the State, we do have a real problem. But if we just look at the entire green section of the State of Illinois, the green shading shows the major coal seam underlying almost literally two-thirds of our State, and the areas that are shaded in red, these areas running through here, show areas already surface mined.

Much of this had to be done on prime farmland, and certainly is more than the less than one-half percent of prime farmland likely to be disturbed that you mentioned in your written testimony today. That would not apply when it comes to the State of Illinois. From this map I would say that at least 5 percent of the prime farmland in Knox County and Fulton County up in northwestiern Illinois has already been disturbed, let alone what might be mined further over the next 20 years.

I wonder if you could possibly comment on the possible potentially large localized impact, although the aggregate numbers seem much less significant. The aggregate numbers are like unemployment. You can look at the national unemployment of 7½ percent, but when you look at the minority unemployment in East St. Louis, the West

Side and South Side of Chicago, they laugh at it. It is over 50 percent. So that it is our particular concern here; that the national figures really don't apply to us. The impact on us is very severe.

Mr. **Harris**. It is one of the problems of working with national statistics, Senator, and I am acutely aware of the fact that probably about 50 percent of the available coal available to surface mining that is overlaid by prime farmlands exists in the State of Illinois. Probably my State of Indiana may well rank second. I am not sure of that in the percentage of its prime farmlands underlaid by coal. Certainly the impact, if this were to go unabated in Illinois would be tremendous.

I can assure you that it is not the position of OSM, and will not be during my tenure here, to allow coal to be mined unless we can be assured that the mined lands in the prime farmlands area can be returned to the original condition. The ability of that land to produce crops will have to correspond with that of the land around and within that area that has not been mined.

Senator **Percy**. Very good.

Director Harris, I want to thank you and Mr. Dean Hunt, Director of OSM's Technical Service Division for your testimony this morning. Is it possible for you to stay on during the next panel?

Mr. **Harris**. Yes, sir.

Senator **Percy**. We would be very happy to have you.

Mr. **Harris**. I will stay with you during the whole period. There was one question that Senator Bumpers raised earlier that has not been addressed, and that was the change in historical use from 5 in 20 years to 5 in 10 years. I would like to cite for Senator Bumpers a bit from a court case here that caused us to make that change, if I may.

Senator **Percy**. All right, fine. Let's do that.

Senator Bumpers, they just now recessed on the floor. I am the floor manager for the foreign assistance bill. This is something that the administration urgently wants. We haven't passed a foreign economic and military assistance bill for several years. It really has the highest priority. I will have to step down and see what is holding them up and see that we move along on that. But I can be back very quickly.

Would you be able to assume the Chair, Senator Bumpers, until I get back? If we do finish after your questioning of Director Harris, if you could call up the next panel, I will be back just as quickly as I can. If I don't get back before you leave, I want to thank you very much.

Mr. **Harris**. Thank you, very much. I will be with you during the rest of the hearing.

Senator **Percy**. That is right. You will be staying on.

Thank you.

Mr. **Harris**. Senator Bumpers, you raised a question about our changing of 5 in 20 years to determine historical use and I would like to cite the Federal Register of January 22, 1981. This is in a preamble to our change in this particular historical use clause. Section 716.7A1 of the initial regulations further define the concept of historical use for intensive agricultural purposes by specifying the historical use period, the period of time the land must have been in crop production as at least 5 out of the 20 years preceding the date of the permit application. 42 FR–62693 of 1977.

The district court enjoined this part of the initial regulations because the regulation was not explained or supported in the preamble and the regulation as written was overly broad. We interpreted that and other findings in the case to be that the court wanted that cut to a lesser period. That was the reason for the change in that relation.

Senator **Bumpers**. Was that an injunction against the Office of Surface Mining?

Mr. **Harris**. No, sir.

Senator **Bumpers**. Who were the parties to that lawsuit, Mr. Harris?

Mr. **Harris**. Just a second, sir. I cannot cite it, I believe. The references to surface mining litigation 456–F supplement at 1312 DDC 1978, Mr. Hunt——

Senator **Bumpers**. Who were the parties to the suit?

Mr. **Hunt**. The Department of the Interior was the defendant and there was a wide variety of parties that participated.

Senator **Bumpers**. Coal operators mostly were the plaintiffs.

Mr. **Harris**. There were many issues in the litigation. Coal operators and environmentalists and other public citizens interested in the regulations were parties to the suit.

Senator **Bumpers**. What was the date of the decision?

Is that the District Court of Illinois?

Mr. **Harris**. No. That was the Federal District Court for the District of Columbia.

Senator **Bumpers**. What was the date?

Mr. **Harris**. August 4, 1978.

Senator **Bumpers**. Did Interior appeal that decision?

Mr. **Harris**. Yes, they did.

Senator **Bumpers**. Is it now in appeal?

Mr. **Harris**. I have to look at my legal staff here for an answer.

Senator **Bumpers**. They seem as confused about it as you and I.

Mr. **Harris**. Senator, I believe that it is the case that involves the interim regulations and the appeals on that have been concluded.

Senator **Bumpers**. The appeals have been concluded?

Mr. **Harris**. That is right.

Senator **Bumpers**. At what level?

Mr. **Harris**. Concluded before the U.S. Court of Appeals for the District of Columbia.

Senator **Bumpers**. When was that decision rendered?

Mr. **Harris**. Sometime in early 1980 to the best of my knowledge.

Senator **Bumpers**. No appeal was entered. Was it affirmed?

Mr. **Harris**. I believe that is correct. Excuse me.

Senator **Bumpers**. No appeal was taken from that decision to the Supreme Court?

Mr. **Harris**. No, sir. There is litigation now in the permanent regulations that were promulgated under the Carter administration. That still is ongoing.

Senator **Bumpers**. Is it the present rule or proposed rule that instead of being mined 5 years out of the 20 prior to the permanent application, the time frame now is 5 out of 10 years?

Mr. HARRIS. Farmed 5 out of 10.

Senator BUMPERS. Farm?

Mr. HARRIS. Yes.

Senator BUMPERS. There was some other term there than just farmed. There was a distinction made between cropland and cultivated land, was there not?

Mr. HARRIS. Yes.

Senator BUMPERS. The old rule referred to cultivated land; is that correct?

Mr. HARRIS. Yes, it is.

Senator BUMPERS. Is that correct? All of you come up to the table.

Mr. HARRIS. When you get into the legal issues, I have to call on them.

Senator BUMPERS. Call on whomever you think would be most helpful to you.

Mr. HUNT. The distinction from the word "cultivated" to the word "cropland" was made so that we would have consistent language throughout the rule. It wasn't intended to be a substantive change.

Senator BUMPERS. What is the word now?

Mr. HUNT. Cropland.

Senator BUMPERS. How do you perceive the difference?

What is the difference between cropland and cultivated land?

Mr. HUNT. There is no difference. The change was made purely so that our rules would be consistent throughout. We do get into a problem——

Senator BUMPERS. Were there inconsistencies prior to that, that is, some places where the rules said "cultivated" and other places said "cropland"?

Mr. HUNT. Yes.

Senator BUMPERS. Let me ask you this: Do you consider a meadow that is used for hay baling in the summertime cultivated land? Do we have anybody from the Department of Agriculture here?

Mr. HUNT. Sir, could you ask——

Senator BUMPERS. I have always thought of cultivated land as land that could be tilled and plowed and have crops raised on it and so on. I thought of cropland as that which includes cultivated land but also includes meadows, pastures, and other lands that are not cultivated.

Mr. HUNT. Yes. You could consider the phrase "cropland" somewhat broader, I think, but we have been using the terms interchangeably in the Office of Surface Mining.

Senator BUMPERS. Just for the record, then, so far as you are concerned it isn't necessary that the farmland be plowed, tilled and cultivated in the strict sense to be considered prime farmlands, if it is pasture land or meadow land, it would still be considered cropland and could be prime farmland. Is that right?

Mr. HARRIS. Yes. The prime farmland determination goes back to the determination of soil quality. The only thing we are determining here is historical use. So I don't think that the interchange of those two words——

Senator BUMPERS. When you talk about historical use, Mr. Harris, you are talking about historical use as cultivated land. If the land has been farmed, does that mean it has been cultivated?

Mr. **Harris**. I have here the definition of cropland, if I could read that.

Senator **Bumpers**. Please do that.

Mr. **Harris**. Cropland means land used for the production of adapted crops for harvest alone or in rotation with grasses and includes row crops, small grain crops, hay crops, nursery crops, or charred and other specialty crops.

Senator **Bumpers**. I think that is sufficient. That definition satisfies me.

There are a few places in your testimony here, Mr. Harris, that I want to go into, but first I want to ask you whether you personally agree with the thrust of the prime farmland provision of this act?

Mr. **Harris**. Yes, I do.

Senator **Bumpers**. Do you think that, to the best of the operators' ability, the land should be put back to its former productivity that it enjoyed before it was mined?

Mr. **Harris**. Yes, sir.

Senator **Bumpers**. I would like to point out that grandfathering operations remain subject to all other performance standards of SMCRA, including those relating to the topsoil, revegetation, possible mining land use and bonding. I am not clear what the purpose of the grandfather clause is if they are subject to all the performance standards set out in the bill.

Let me ask you this: Let's take Illinois, whose plan has not been approved. Let's assume that it has not been approved say come August of 1982. Who is going to determine what the performance standards are if their State plan has not been approved?

Mr. **Harris**. They will have by that time the Federal program if their State program has not been approved for the State of Illinois and the Federal Government, OSM will make that determination based upon the Department of Agriculture standards.

Senator **Bumpers**. Mr Harris, section 515(B)7 says for all prime farmlands as identified in sections 3507(B)16 to be mined and reclaimed, specifications for soil removal, storage, replacement and reconstruction shall be established by the Secretary of Agriculture and the operator shall as a minimum be required to do certain things. There is a very long list of the things that he shall be required to do as a minimum.

Mr. **Harris**. Yes, sir.

Senator **Bumpers**. No. 1, has the Secretary of Agriculture established those standards for Illinois in case their State plan has not been approved?

Mr. **Harris**. I think that the Secretary of Agriculture has established that for all prime farmlands. Yes, sir.

Senator **Bumpers**. Is it your understanding, since you say that they still must comply with all performance standards then that in August of 1982, the operators who have been grandfathered still must comply with those standards?

Mr. **Harris**. With all of the standards having to do with reclamation except about five pages that address strictly prime farmland reclamation.

Senator **Bumpers**. That is what I am concerned about, the five pages you have taken out. You can take one line out of most things around here and just strike B and you don't have a law. [Laughter.]

I am curious about whether or not you have stricken the "be it enacted" clause of this?

Mr. **Harris**. I assure you that we haven't sir. What we did in taking out the 1982 date was the attempt to build, as the previous administration had not done, enough public comment and give it enough consideration to draft a regulation that could stand court tests which we were sure the previous administration's regulation could not stand.

It was subject to a great deal of question as to what was actually meant by it. Mr. Hunt explained this earlier. What we are attempting to do is get a regulation on the books that is so right that it will withstand the attacks in court.

Senator **Bumpers**. What is the most significant part in those five pages as far as you are concerned?

Mr. **Harris**. It is probably restoration to a level that the reclaimed land will equal the productivity of the nonmined lands in the area.

Senator **Bumpers**. How have you changed that? Have you just deleted that?

Mr. **Harris**. We have not changed it. That is still in the prime farmland section. The question is what lands can be mined under the grandfathering clause and these are limited amounts. We set specific limits to those lands the mining company had either ownership or existing leases on prior to 1977. This is not something they can extend for any indefinite period. It is very specific in that area.

Then we went ahead and requested public comment so that we could have enough information to come forward with a well thought out logical regulation in that area which we felt the previous administration had not done.

Senator **Bumpers**. I am going to have a look at those five pages myself, and hopefully maybe the Energy Committee will pursue this hearing to get more definitive information about the pages that have been removed.

When would you anticipate——

Mr. **Harris**. Those have not been removed. They are still there. We are only talking about the fact that you have 150 pages having to do with the restoration of mined lands and about 5 pages that are specifically directed to the reclamation prime farmlands. What we are saying is that that very small amount of land that might be mined as a result of grandfathering has to meet the minimum set for the reclamation of other types of farmland, and might not necessarily need to meet the explicit criteria for prime farmland but that does not let them off the hook on reclamation.

Senator **Bumpers**. The reason I am confused about that is your testimony says "I have taken the liberty to pull out" the pages applicable to the prime farmlands.

Mr. **Harris**. I didn't go through a dog and pony show. I had these in a book. I meant to pull them out and show them to you. I was going to show you those as opposed to the others.

Senator **Bumpers**. I certainly misunderstood that.

Mr. **Harris**. I am sorry about that.

Senator **Bumpers**. I am reluctant to question you about Secretary Watt's testimony but he said this morning that you were in the process of making regulatory changes which will allow the marketplace to determine the amount of Federal coal reserves that are to be leased and developed. What does that mean to you?

Mr. HARRIS. That is not a part of the function of OSM. That comes under the Bureau of Land Management principally. I think I know the Secretary's philosophy.

Senator BUMPERS. Why don't you have a go at it.

Mr. HARRIS. I will try to interpret for you. I think it is the Secretary's position that Federal lands, principally in the West that are underlain by large coal reserves, should be made available to the mining industry as necessary to meet the production requirements of the country.

Senator BUMPERS. Let me also ask you this. He further says the act is basically a good piece of legislation but the regulations that were promulgated were based on an inflexible interpretation of the act. As a result, they have limited coal production and thus stifled the use of this important energy resource.

How have they stifled coal production?

Mr. HARRIS. In several ways. I think that a part of the future of the coal industry in this country rests with our ability to compete in the international market for the sale of coal. We, probably more than any coal exporting country in the world, give a great deal of attention to the reclamation of mining lands. Every time there is something that is unnecessary added to the reclamation process that ricochets through the cost of producing coal and gives you a higher level at which you must charge for export coal from this country.

The National Academy of Science, the General Accounting Office——

Senator BUMPERS. Mr. Harris, you are not going to suggest that exporting coal to other countries is more important than reclaiming our own land, are you?

Mr. HARRIS. No, sir. I do not intend to infer that and I don't see how you could have taken that from what I said.

Senator BUMPERS. Start over again.

Mr. HARRIS. All right. What I am saying is that we look forward, I think as a nation, to supplying the free world and ourselves with coal at the least possible cost that it can be put on top of the ground in keeping with good reclamation practices. When you put in inflexible regulations that in many cases were counterproductive and certainly not cost efficient and added nothing to the reclamation process, then you are adding to the cost of the coal that is produced here with which we must not only fuel our own country, but with which we must help the rest of the free world to fuel theirs.

I am not saying that we should back off one iota on our reclamation efforts. What I am saying is that adding to those costs with useless and overburdensome regulations that add nothing to the final environmental end product hurt the coal industry in this country.

Senator BUMPERS. Give me an example of the regulations that add nothing to the reclamation of the land?

Mr. HARRIS. All right. In the Eastern Slope Mountain Top removal areas, the previous administration——

Senator BUMPERS. We are discussing prime farmlands here.

Mr. HARRIS. You asked me about regulations.

Senator BUMPERS. I am only interested in prime farmlands. I think I know the illustration you are going to use and I probably agree with it. I want to discuss prime farmlands.

Mr. HARRIS. On prime farmlands, I would be hard pressed at this point to pick out one change that we have made in the prime farmland situation that added or subtracted a great deal from the cost of the production of coal. We have not made large regulatory changes there. But the Secretary was speaking to a broad general situation having to do with mining on a nationwide basis. Here you are asking me to address something that he was speaking about on a nationwide basis in one particular area. That is very difficult to do.

Senator BUMPERS. I certainly didn't intend to entrap you, but you didn't say that you were only talking about nonprime farmlands. You just said the thrust of this administration is to export as much coal as possible at the lowest possible price. And that regulations added nothing.

Mr. HARRIS. I added in keeping with good environmental practice, sir.

Senator BUMPERS. There isn't any point in getting into an argument about that. As I say, the thrust of this hearing deals with prime farmlands. When you said that I assumed that you were talking about prime farmlands. As I said, I am not trying to trap you with the Secretary's words, but I assume you all talked to each other periodically about these things.

Mr. HARRIS. We do. But what you asked me, sir, had to do with his statement on coal nationwide and you restricted my answer to the prime farmlands. It is difficult for me to answer a question concerning the Secretary's statement that was a statement having to do with nationwide coal production by confining it to prime farmlands.

Senator BUMPERS. He didn't exclude prime farmlands?

Mr. HARRIS. No, but he didn't speak specifically to prime farmlands.

Senator BUMPERS. We all know why we are here. Let's talk about the reclamation of prime farmlands. The Secretary also said we will provide regulations, guidelines and handbooks establishing minimum national standards and good engineering practices for mined land for reclamation. I don't know what the intent of the Congress is now, but I sure as hell can tell you when we established this bill it was not to establish the minimum standards. It was to reclaim the land and put it back into the productivity it enjoyed before it was mined. This admittedly is a costly item, but when you look at the map you can see we have no alternative.

Mr. HARRIS. Senator Bumpers, I think you are misinterpreting minimum standard. What that means is the States can add anything that they want additional to the standards that are set in the act and the regulations to their reclamation effort and their mining effort. What we are doing is setting a minimum standard for mining and reclamation and allowing the States to add whatever they see fit to their own program.

Senator BUMPERS. What kind of a date would you like to set as a cutoff date for the grandfather clause exemptions? I voted for the grandfather clause, incidentally. I have no objection to it. I thought it was unfair to do otherwise. But all things have to come to an end.

Mr. **Harris**. I don't think I am in the position today to do this, as we are in the rulemaking process on this particular item and while we have asked for public comment, we are here today to listen. As I stated in my opening statement, we even postponed the closing of public comment periods on the portion of this in order to take into consideration the comments that are made here today. We left an open door for public comment on the cutoff date situation because it says in the register that we want public comment on this particular area.

Senator **Bumpers**. Let me ask you this, Mr. Harris. Can you assure me that a date will be set?

Mr. **Harris**. I think there will be a date set probably. [Laughter.]

Senator **Bumpers**. This is why we are here. This is one of the primary things that I wanted to elicit from you. Will a date be set?

Mr. **Harris**. Let me address that. The problem that comes up is the problem of taking under the fifth amendment——

Senator **Bumpers**. I want to get into that fifth amendment issue in a minute, too.

Mr. **Harris**. If the coal operators had valid existing rights and had made substantial commitment, as the act says, to that mine, then I have every reason to believe that if they owned the minerals at the time of the passage of the act, or had valid existing leases on that property at the time of the act, then they had substantial commitment as set out in the act and probably can make very strong arguments under the fifth amendment.

Senator **Bumpers**. Has anybody raised the fifth amendment argument with the Office of Surface Mining?

Mr. **Harris**. The fifth amendment was handled recently by the Supreme Court, as a result two suits, one from Virginia and one from Indiana, and taking was the question. As I understand the resolution by the Supreme Court at that time, they said that it was not timely and that at no time thus far had there been a taking and if, in the future, there was such taking without due process or without proper compensation, that the court would again take the problem under consideration.

Senator **Bumpers**. Mr. Hunt, let me ask you this.

If I had a discharge permit to dump in the Potomac River, and it was found 5 years after I started discharging that everybody that drank water was going to get cancer as a result of that discharge. and the Federal Government says I could no longer discharge there, would you consider that a taking? Say I had to close my plant down. Would that be a taking?

Mr. **Hunt**. Certainly that is an issue that has been through a lot of litigation. I can't say whether that would be a taking or not but I think that there is no question that the variety of environmental protection standards including those that are incorporated in Public Law 95–87 have been upheld under those types of challenges. I cited the fifth amendment because it is an issue and it was also an issue that was brought up in the consideration of this particular part of the act. One of the reasons, as I remember the legislative history of this part of the act, why the grandfather exemption was included was to avoid the fifth amendment issue.

If we were to ignore that consideration when it was something that was specifically raised by Congress, it was something specifically included in consideration of the inclusion of this——

Senator **Bumpers**. Was there a grandfather clause for anybody else besides prime farmland operators?

Mr. **Hunt**. Yes. For mining under the alluvian valley floors, there is a grandfather exclusion.

Senator **Bumpers**. I remember that one. Anyone else?

Mr. **Hunt**. I don't think there is.

Senator **Bumpers**. Why would it be a taking for prime farmlands and not for everybody else?

Mr. **Hunt**. Excuse me. Under lands unsuitable, existing rights, valid existing rights.

Senator **Bumpers**. Let's take Charleston, Ark., where most of the coal in the State of Arkansas is mined. Those lands don't meet any of these criteria. The Arkansas plan has been approved. Those operators are in compliance now. Why is it not a taking for them, when a lot of those permits existed a long time before this bill was passed? Why is it not a taking for them but it is a taking for an operator who has to have a lease on prime farmlands?

Mr. **Hunt**. Don?

Mr. **Tindal**. These are technical questions. I don't think I can answer all of them.

Senator **Bumpers**. I get the feeling OSM is the party raising the fifth amendment issue.

Mr. **Tindal**. Don Tindal, Solicitor's Office. There is very definitely a question of the fifth amendment and the example that you gave is, I don't think, not completely synonymous with the situation we find with prime farmland. A company which dumps sewage into the river and then is stopped can take other actions to dispose of that. That is a little different than where you have a company or an individual who has valid rights, valid ownership rights, valid contract rights, and the Government then passes a law that places a restriction on those rights such that it could be considered a taking. The question is whether the Government can do that without compensating that individual.

That was the concern in the statute as you know in placing that grandfather clause in there.

Senator **Bumpers**. Are you familiar with the Supreme Court decision Mr. Hunt mentioned a moment ago?

Mr. **Tindal**. Yes.

Senator **Bumpers**. Generally what was that decision? Who were the parties and, how was the issue raised?

Mr. **Tindal**. I am not sure which case it was. They were both argued on the same day, whether it was Indiana or Virginia. The question was whether or not there was a taking. Based on the specific language of the statute there was no case in controversy. There was no site specific case before the Supreme Court. And the court stated that based upon that, they were not going to decide that issue, indicating, if I am not mistaken, that when that case came up, on a site specific situation, the court would be amenable to then considering the fifth amendment question.

Mr. **Harris**. Senator Bumpers, I want to make one statement concerning something you said just a minute ago. Obviously in the legislative history of the grandfather clause, one of the things that they were attempting to circumvent was the possible fifth amendment question. Two States filed suits in Federal court concerning the fifth amendment question. They were joined by a number of other States and yet you say you think that the OSM is the one raising the fifth amendment question. In view of all of that history, I think that is an unfair statement.

Senator BUMPERS. It may be. That issue was raised and discarded before; it was discussed when the grandfather clause was adopted and the legal opinion at that time was that that was not really a serious problem on this. We have a public interest here which I think is much broader than that particular issue.

Mr. HARRIS. The Supreme Court has not settled the question yet on the fifth amendment situation.

Senator BUMPERS. If you have a cutoff date, everybody is going to be put in the same category which at least diminishes the fifth amendment argument.

Mr. TINDAL. This is the question that we are asking for input on in the existing rulemaking before a final determination by OSM is made as to how it handles the question of cutoff or no cutoff.

Mr. HUNT. I might add, Senator Bumpers, that we are very cognizant of the public interest here. We didn't take this action lightly. We carefully considered the problems that would be raised by the delay of this particular rule. We feel confident that we can go through another complete rulemaking prior to August 1982 and have a new rule effective within the time period that the prior rule would have taken effect.

Additionally, after careful consideration of the amount of lands that would be affected and the problems with the interpretation of the rule we have, we felt it was a better approach to sit back and receive public comment in another round. This gives us an opportunity to develop a better administrative record and to consider the comments from all parties. I think the one thing that Dick has indicated, we want to follow the requirements of the Administrative Procedures Act and we want to develop an adequate administrative record for whatever final step we do take.

This is one approach to maintaining that ability to comply with those requirements of the law.

Senator BUMPERS. Let me ask you this. Why is it not better to go ahead and set a cutoff date and if the operators want to pursue the fifth amendment argument, they can pursue it and if they are entitled to compensation, they are entitled to compensation? Not to do anything, not to set a date, and to allow those people who are grandfathered just to continue mining because they have a continuous seam of coal really thwarts the thrust of the act.

Mr. HARRIS. It is not nearly as simple as having a continous seam of coal.

Senator BUMPERS. That is just one criteria. I understand that.

Mr. HARRIS. We have stated very specifically in the rule that with that they must have either ownership or a lease on that property. So you are not talking about extension based on a continuous seam of coal. We are talking their going on almost forever without being grandfathered out and that is not the intent of what we have put on the books.

Senator **Bumpers**. Under the previous regulation, the grandfather clause covered an extension of a continuous mining pit, part of a single permitted operation, or part of a continuous recoverable seam. Those were the previous regulations. So I recognize that that is only one criteria in determining whether somebody is entitled to be grandfathered. But my guess is that you are going to have people mining coal 20 years from now under this grandfather clause if you don't bring it to a close.

I don't know of anything that would thwart the intent of the bill more than that.

Mr. **Harris**. Only if that particular mining operator had at that time title to the coal, or a lease on the coal. I don't think you are going to find anybody that——

Mr. **Tindal**. There is no indication in the statute.

Senator **Bumpers**. I might say most coal leases cover a prescribed tract of land and they provide for a royalty as long as coal is mined from that tract. How long it is going to last is going to depend on how big the seam is and how big the lease is in the first place.

Mr. **Tindal**. There is no cutoff date in the statute, no indication of date.

Senator **Bumpers**. I understand that. How did the previous administration arrive at the cutoff date?

Mr. **Tindal**. That I am not sure of. I think it is the same concern that you are expressing. They decided that, and as far as I know it was more or less on an arbitrary basis, that 5 years was enough. There is a question about whether that is constitutional. I think what we are trying to do is to get comments on whether or not there should be a cutoff date or not be a cutoff date and to reflect in the regulations the extent of the existing property or contractual rights that the coal owners own.

Senator **Bumpers**. Mr. Harris, do you plan to continue the experimental practice program, allowing an operator to use an experimental practice under the regulations, and if so, are you going to require them to prove that it has been successful in other areas? Are you making any proposed changes in the regulations governing use of experimental practices?

Mr. **Harris**. I have a prepared statement of experimental practices to put in the record consistently what I have in mind. The reason that I think that we need to provide for experimental practices in some areas of prime farmland is that in different areas of the country we are getting very different results from reclamation. In the State of Washington I am told, and I don't have specifics before me on it, that with 80 inches of rainfall their topsoil has become so leached that they can mix their topsoil in A and B horizons and reclaim their farmlands and have a better productivity after reclamation than they had before.

We know of other areas where you have a hard pan below the soil where that postmining reclamation properly done is increasing yield. So we also know that there are areas in which operators have not been able to approach closely the premining productivity.

So with that kind of varying results I think it is necessary to establish some experimental practices to see what can de done, but I would like to read a statement here into the record with your permission on experimental practices.

Senator **Bumpers**. Let me just suggest you provide it for the record.[1]

Mr. **Harris**. All right.

What I am saying here is that the experimental practices must be properly approved. They must leave the land in no less condition than it was prior to the experimental practice.

Senator **Bumpers**. Do you agree with Secretary Watt that we need to start producing as much coal as possible as quickly as possible?

Mr. **Harris**. I think we need to meet the market demand.

Senator **Bumpers**. Are we not doing that now?

Mr. **Harris**. We are at this time. But anticipated market demands are much in excess of what we are producing today.

Senator **Bumpers**. What is that anticipated demand?

Mr. **Harris**. I don't have those figures with me but it is increasing very rapidly, especially with the exports.

Senator **Bumpers**. How much coal do you anticipate being mined in the United States this year?

Mr. **Harris**. About 800 million tons.

Senator **Bumpers**. What was mined last year?

Mr. **Harris**. Something slightly less than that.

Senator **Bumpers**. What is the price of coal?

Mr. **Harris**. We can get the answers to this for the record if you would like.[2]

Senator **Bumpers**. Do you know what coal in West Virginia, for example, is selling for right now?

Mr. **Harris**. It depends upon whether it is steam coal or metallurgical coal. Metallurgical coal I understand, and I am no expert on coal prices today because I am precluded from being in that market, is running somewhere up to $56, $57 a ton. Other steam coal on spot market, long-term contract, varies widely but I would say probably steam coal, $20 or something like that in the eastern market.

Senator **Bumpers**. I can show you a lot of operators that would like to get $20 a ton.

Mr. **Harris**. I am talking about averages.

Senator **Bumpers**. Finally, let me just emphasize this for the record. In your statement you say:

> I want to assure you that through our regulatory reform efforts we will continue to comply with all existing requirements of Public Law 95-87, requiring equivalent levels of soil productivity on all prime farmlands as exist on nonminede prim farmlands in the surrounding area, and requiring that operators comply fully with special environmental protection standards for soil handling and restoring and restoration during mining.

I welcome that comment. I hope I don't ever have to remind you of that comment.

Gentlemen, thank you very much. Chairman Percy asked if you could stay while the panel testified. I am going to call the panel. I am going to have to leave. I will try to find Senator Percy to see if he can come back and finish this hearing.

Mr. **Harris**. I will stay, Senator. And thank you very much.

[The prepared statement of Mr. Watt and material submitted by Mr. Harris follows:]

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[1] See p. 41.

[2] See p. 43.

PREPARED STATEMENT OF JAMES G. WATT
SECRETARY OF THE INTERIOR

Mr. Chairman and Members of the Subcommittee:

I appreciate the opportunity to appear today to discuss our Nation's coal development and the role of the Department of the Interior in that development.

This week we have celebrated the 200th anniversary of a major watershed in our Nation's fight for Independence --the triumph of American and French forces, commanded by General Washington, over Lord Cornwallis and his armies at Yorktown. Today, we find ourselves again involved in a fight for independence -- energy and economic independence. The challenge today, like that two centuries earlier, is our economic and political survival. Unresolved, our energy and economic problems could drag us back to an economic and political bondage like that from which the colonists broke in 1781. Thus, we must seek, and we are seeking, an energy watershed in our struggle, an energy and economic equivilent of Yorktown.

Recognition that coal is our Nation's best hope for energy and economic independence is the first step toward that "Yorktown". Coal is being rediscovered. America's most abundant fossil fuel had powered the country's shift from an agrarian to an industrialized society in the late nineteenth and early twentieth centuries. After World War II, however, coal experienced a dramatic decline in key markets, and soon the local coal delivery truck, the coal-fired boiler used in the factory, and the steam locomotive practically vanished from the American landscape. In 1946, coal supplied about half of America's total energy needs. In 1978, it accounted for less than 20 percent of total U.S. energy consumption.

The Arab oil embargo and the shocking realization of America's growing dependence on foreign oil really signaled the public's rediscovery of coal. Suddenly, the United States was called the "Persian Gulf of coal", and the resource itself was termed the "great black hope". While projections of our coal resources vary widely, the U.S. Geological Survey has estimated total U.S. coal resources at about 4 trillion tons. Recoverable reserves, based on present day technology, are estimated to be more than 300 billion tons. It is safe to assume that the United States has enough coal -- if one looks only at the physical resource itself — to support any foreseeable level of consumption for at least the next one hundred years. Clearly, coal has the potential to become our Nation's short-term guarantee for greater energy independence.

Since the 1973 oil embargo, U.S. coal production has increased by approximately 40 percent. The largest use of coal, accounting for approximately 65 percent of this Nation's annual coal consumption is electric power generation. Last year, for the first time ever, according to the National Electrical Reliability Council, over half of the electricity generated was produced from coal-fired units. The 1,333 coal-fired generating units currently in operation used approximately 563.5 million tons of coal, producing over 253 thousand megawatts of electricity in 1980. The Department of Energy reports that there are 230 new coal-fired plants planned or under construction which will begin operating by 1990. Thus, by 1990, it is estimated that utilities will need over 880 million tons of coal for electric generation -- more than our total, record-breaking coal production last year. By the year 2000, the Edison Electric Institute predicts an annual need for 1.5 billion tons of coal for power generation alone. To meet that need, steam coal production must increase by 170 percent.

Increased use of coal will not only decrease our dependence on foreign oil, but it will also contribute to our National balance of payments. Increased production of domestic coal will cut our balance of payments deficit, which results mainly from our spending almost $200 million a day to import approximately 5.5 million barrels of crude oil and oil by-products. Further, other nations need our coal, and coal sales can also improve our balance of payments. We can supply their needs and meet our needs, but only if we do not make it difficult to mine our coal.

The transition to coal useage, however, has proved difficult. One of the biggest impediments to expanded use of coal has been lack of Federal leasing. Between 1971 and 1980, Federal coal leasing was extremely limited, and leases were only issued to maintain production or to prevent the bypass of Federal coal.

A Federal coal management program was adopted in 1979 that resulted in the first regional leases being issued this year. While new leasing is taking place, several areas of the program have been identified by the coal industry, State and local governments, and the public as being confusing, and unnecessarily complex. As a result of a comprehensive review of the Federal coal management regulations, the Department is now in the process of revising those regulations to strengthen the program and add needed flexibility. The result of these regulatory changes will allow the market place to determine the amount of Federal coal reserves that are leased and developed. Of course, the Federal reserves will be leased under a land use process that recognizes multiple use management practices, and that ensures continued State participation in leasing decisions.

Another impediment to the development of coal has been the regulations which were promulgated under Public Law 95-87, the Surface Mining Act Control and Reclamation Act of 1977. The Act is basically a good piece of legislation, but the regulations that were promulgated were based on a strict, inflexible interpretation of the Act. As a result, they have limited coal production, and thus, stifled the use of this important energy resource. We are committed to revision of the Act's regulations to ensure production of an adequate supply of coal for our Nation, and to ensure that that production occurs in an environmentally sound manner.

This Department, and the Office of Surface Mining will continue to have an important role in assuring the protection of the Nation's environmental and agricultural resources. We will provide regulations, guidelines, and handbooks establishing minimum national standards and good engineering practices for mined land reclamation. We will work with the States to improve their administration and enforcement programs through direct technical assisstance, through grants in aid, and through management and policy direction and advice. We will conduct a vigorous oversight program geared toward working cooperatively with the State regulatory authorities to ensure that they have the capabilities, to carry out the mandate and responsibilities of the program, and that they are in fact doing so.

While coal production is our bridge from dependence on oil and gas to the full-scale development of renewable resources, we cannot afford to lose sight of the national interest in the protection of our farmlands, particularly the prime farmlands of the

Midwest. They are the finest farmlands in the world -- and we cannot let them be degraded to where they will no longer grow the crops this country and the world need. Thus, we are carefully reexamining our regulations on prime farmlands.

Dick Harris, the Director of the Office of Surface Mining, is with me this morning to address our efforts on the prime farm land regulations. At this time, Mr. Chairman, I would like to let him present his statement, and then we will be pleased to answer the questions of the Subcommittee.

MATERIAL SUBMITTED BY MR. HARRIS

Experimental Practices

Section 711 of the Surface Mining Control and Reclamation Act of 1977 allows the use of experimental practices under limited conditions. The experimental practice must be approved in writing by both the regulatory authority and the Director, Office of Surface Mining (OSM) and may only be granted were the following conditions are met:

- The experimental practice is potentially more or at least as environmentally protective during and after mining operations, as those required by promulgated standards.
- The mining operations approved for particular land use or other purposes are not larger or more numerous than necessary to determine the effectiveness and economic feasibility of the experimental practice.
- The experimental practice does not reduce the protection afforded public health and safety below that provided by promulated regulations.

All experimental practices must be specifically identified through newspaper advertisements and written notifications and each permit which incorporates an experimental practice must be reviewed in its entirety at least every three years, or at least once prior to the middle of the permit term. Revisions or modifications of the permit may be imposed as necessary to ensure that the operations involved are conducted to fully protect the environment and public health and safety.

As you can see, the experimental practice is a carefully controlled device designed to permit the development of alternative surface coal mining and reclamation operation practices for experimental or research purposes. There is no question that the coal mine reclamation technology is an evolving science. It is, in my opinion, essential that we not freeze the state-of-the-art at current levels. I would equate such an approach to saying that we should have frozen further advances in the engineering and design of the automobile after development of the Model-T. No doubt there are people who would think that it would have been a good idea. Such an approach would, however, deny the heritage that has made this country great.

It is my opinion that this country must commit itself to a reasoned, environmentally conscious program for developing and utilizing the tremendous energy resources we possess. Unless we have such a program, I fear mounting economic, social and political pressures will force the federal and state governments in a crisis situation into a crash program to move coal to the surface regardless of the environmental consequences. All too often, the federal government moves in a crisis, not with the precision of a surgeon's scalpel, but with the force of a meat axe. As you, Mr. Chairman, I am committed to avoiding this eventuality in the area of coal mine reclamation. I want the right kind of development to come over time, not the wrong kind of development to come in a crisis. I believe that everyone who is truly sensitive to the values and beauty of the Nation's natural resources would agree with these sentiments.

In the process of revitalizing the Nation's economy, I believe there is a place for the controlled use of experimental practices. I have not received any proposals for experimental practices with respect to the mining of prime farmlands and it would be difficult, absent a site-specific proposal, to predict what practices may or may not have merit. Depending upon budget cut backs, I would hope, through OSM's research program over the next several years, that we can take a good hard look at the problems and varying techniques for the reclamation of, not only the Nation's prime farmlands, but all farmlands and provide a proper framework for resolving some of the conflicts between these often competing land uses and assuring the proper restoration of these lands.

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

COMMUNITY AND ECONOMIC
DEVELOPMENT DIVISION

B-203769

AUGUST 5, 1981

The Honorable James G. Watt
The Secretary of the Interior

Dear Mr. Secretary:

Subject: Comments on Interior's Surface Mining Regulations (CED-81-145)

The General Accounting Office has been reviewing the Office of Surface Mining Reclamation and Enforcement (OSM), Department of the Interior, regulations implementing the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87). We initiated this review to follow-up on our September 21, 1979, report entitled "Issues Surrounding the Surface Mining Control and Reclamation Act" (CED-79-83) and because of congressional, State, industry, and public interest and controversy in controlling and reclaiming coal surface mined areas.

OSM is in the process of making major revisions to its regulations and we, therefore, do not plan further work at this time. However, during our regulatory analysis of seven regulations and discussions with various officials, we identified issues which we are suggesting OSM consider while revising its regulations.

--In 1978 OSM promulgated detailed design standards regulating the use of explosives to free the overburden from coal seams. According to many sources, studies on blasting's effects do not support OSM's proposed final regulations. In view of these studies OSM needs to review its support for its revised blasting regulations. Also, a legislative change may be needed to clarify the act's blast damage provision, which does not allow any building structure damage off the mine permit area. Some damage may be inevitable from blasting and overly stringent regulations could be excessively costly. (See pp. 6 and 7.)

--Before the act, some coal lands previously mined were degrading the environment because States did not require adequate financial protection when coal operators failed to complete reclamation work. The act and OSM's regulations changed this by requiring coal mine operators to obtain bonds guaranteeing that mined areas will be reclaimed. However, small operators are experiencing problems obtaining performance bonds from bonding companies because the companies object to certain provisions of the act, such as those relating to the bond's duration and amount. The act allows for alternatives to bonding such as a State reclamation fund. Based on our talks with West Virginia and Pennsylvania officials, alternatives appear attractive because they do not require bonding companies' participation and can provide for other short- and long-term environmental benefits addressed by the act. Overemphasizing bonding programs may create economic hardship for the small operator and inadequate funding for reclamation of coal mined lands. OSM needs to emphasize alternatives to bonding while revising its regulations. (See pp. 8 to 10.)

--The act provides an exemption (grandfather clause) for coal mine operators mining prime farmlands, provided they were mining them at the time the act became law. In May 1980, the U.S. Appeals Court for the District of Columbia issued a decision which might be viewed as allowing a coal operator with a preexisting permit to continue mining along a seam by buying or leasing coal rights without complying with the prime farmland provisions because of the exemption. In addition, our previous report showed that State and local land-use laws may reduce the possibility that prime farmland will be farmed following reclamation. Legislative changes may be needed to preserve prime farmlands by limiting the grandfather clause and land-use options. (See pp. 10 and 11.)

--Unchecked sediment (runoff) from coal mining operations can pollute and severely damage fish, water supplies, recreational areas and increase flood frequency. OSM developed design standards, including requiring coal operators to use sediment ponds to meet a uniform water quality performance standard. However, we believe these design standards do not adequately address the differing climatological, geological, and topographical conditions of each coal mining area and thereby limit State and coal mine operator flexibility in controlling sediment. Several Federal studies have raised questions about the need for and specific size of sediment ponds. Also, decreasing a stream's natural sediment level to meet a uniform water quality standard may adversely affect the stream by causing erosion damage. The State regulatory authority could be allowed to decide, on a site-by-site basis, the best method of controlling sediment without exceeding a stream's natural sediment level. (See pp. 12 and 13.)

- —Coal mining generates acid water, which is extremely hazardous when discharged into waterways. Therefore, the act attempted to prevent such discharge by prohibiting entering a coal seam at a lower portion of the slope and mining in an upward direction. However, the prohibition may cause, rather than prevent, acid water drainage by increasing water pressure elsewhere in the mine causing acid water discharges. West Virginia and Pennsylvania officials told us that a site-by-site analysis appears needed to prevent acid water drainage regardless of mining method. A legislative change would be needed to eliminate the prohibition. (See pp. 13 and 14.)

- —The overall thrust of the act's and OSM's excess spoil standards is to prevent haphazard dumping of spoil material, especially into valleys, which causes erosion, acid drainage, landslides, and water quality problems. However, the standards appear to unnecessarily limit the coal operators' flexibility while providing little additional environmental protection. According to a study done for the Bureau of Mines, operators could use other than OSM methods in providing environmentally safe valley fills. For instance, controlled dumping over a cliff could be as safe as truck hauling into valley fills at less cost, but is prohibited by OSM regulations.

  When revising its regulations, OSM needs to consider allowing alternative methods, if environmentally sound, in disposing of excess spoil material. If not possible by regulation, then legislative changes would be needed. (See pp. 14 to 16.)

- —Access roads to coal mines can cause severe environmental damage and need to be regulated. However, OSM attempted to do so by promulgating numerous design criteria for constructing, maintaining, and eliminating the roads. These regulations may not be needed because coal operators already have to comply with numerous other OSM regulations controlling the major environmental hazards of coal roads. When revising the road regulations, OSM needs to be cognizant of regulatory redundancy to prevent regulating mine operators unnecessarily. (See pp. 16 and 17.)

Another matter for your consideration is whether OSM and the States have the monitoring, inspection, and enforcement resources to ensure compliance with the act's and OSM's regulations. Once

OSM has approved their programs, the States will have primary responsibility for inspection and enforcement with OSM having oversight responsibility.

According to the Assistant Director, Technical Services and Research, OSM, the regulatory revisions will give the States and coal operators greater flexibility in meeting the act's environmental objectives. However, regulatory flexibility requires better trained inspectors and may involve a greater number of inspectors to ensure compliance. OSM is planning to reduce its number of inspections, and inspection and enforcement resources in several States may be inadequate. We believe a balance should be maintained between regulatory flexibility and effective monitoring, inspection, and enforcement. Without this balance, coal operators may be put out of business from excessive regulations, resulting in reduced coal production or, conversely, the environment could be severely damaged because of inadequate enforcement.

OBJECTIVE, SCOPE, AND METHODOLOGY

Our objective was to determine if key regulations provided adequate environmental protection while allowing States and coal mine operators sufficient flexibility to choose the appropriate methods necessary to achieve the act's environmental goals at the least cost.

Our review consisted of interviewing officials of four State natural resource agencies (Colorado, Pennsylvania, West Virginia, and Wyoming), four coal associations, two coal companies, two environmental groups, one bonding association, the National Academy of Sciences, the Environmental Protection Agency, the Bureau of Mines, and OSM. During our review we also (1) analyzed technical data supporting surface mining regulations and responses to proposed regulations, (2) identified studies on cost/benefit analysis of environmental regulations and selected surface mining regulations, (3) reviewed the legislative history to determine the intent of the surface mining act, and (4) reviewed pertinent records, documents, and books at Federal agencies. (See p. 18.)

We appreciate the courtesy and cooperation extended to our staff during this review.

Sincerely yours,

Henry Eschwege

Henry Eschwege
Director

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SPECIFIC COMMENTS ON OSM SURFACE MINING REGULATIONS

BLASTING REGULATIONS

Blasting is necessary to free the overburden from the coal seam, but it can cause significant property damage. One study 1/ estimated that in 1975 improper blasting caused over $200 million in damage in the Midwest and Appalachia. In testimony before the Subcommittee on Energy and the Environment, House Committee on Interior and Insular Affairs, an official from the Center for Science in the Public Interest referred to another study which estimated property damage in Appalachia alone for 1965-75 at $1.5 billion.

To prevent blast damage, OSM promulgated in its regulations detailed design standards, including peak particle velocity 2/ and the distance to critical structures. Members of the industry, three States, and some environmental groups filed 22 complaints attacking the regulations in the United States District Court for the District of Columbia. The District Court rejected the attacks. Its decisions are reported as In re Surface Mining Regulation Litigation, 452 F. Supp. 327 (D.D.C. 1978) and 456 F. Supp. 1301 (D.D.C. 1978). The plaintiffs appealed. The Court of Appeals affirmed as to some of the regulations, reversed as to others, and remanded another issue for further proceedings in accordance with its opinion. (In re Surface Mining Regulation Litigation, 627 F.2d 1346 (D.C. Cir. 1980).) The peak particle velocity standard was found by the Court of Appeals to be unsupported by technical data and invalid because it was arbitrary and capricious. The distance regulations were found invalid because the act contains no provision authorizing the Secretary to prescribe distance limitations on blasting, but one section of the act does fix an explicit distance limitation.

OSM published revised blasting regulations for comment in the January 22, 1981, Federal Register. They included peak particle velocity standards partly based on a 1980 study done for the Bureau of Mines. The revised regulations recognize that some damage such as the loosening of old paint and lengthening of old cracks in buildings may occasionally occur.

1/Darcey, D., G. McMahon, E. Burns and B. Ulrickson "Strip Mine Blasting: A Study of Vibrational Pollution in the Eastern and Midwestern Coalfields" (1977).

2/Peak particle velocity is the speed at which geologic material is moved by the blast.

Industry, State, and environmental organizations criticized the revised regulations. Industry groups, including the Society of Explosives Engineers, the professional society of blasting experts, questioned the technical merits of the Bureau's report. Peabody Coal Company estimated the proposed regulations would increase its costs by $6.8 million without any significant environmental benefits. The Old Ben Coal Company said less than 10 firms nationwide had the expertise to comply with a portion of the regulations. An Illinois official said implementing the regulations would be so costly that it would be prohibitive.

The Illinois South Project, an environmental organization, contends OSM's blasting regulations are not consistent with the act's requirement that injury to persons and damage to property and water resources be prevented. According to the organization, OSM regulations cannot allow some threshold damage 1/ (cracks, loose paint, etc.) but must prevent it. Moreover, Illinois South discounts the usefulness of preblast surveys because, as OSM admits, they only document the buildings' structural condition visually apparent but do not analyze the structures' integrity to undergo stress and strain.

OSM is drafting revised blasting regulations to be completed by mid-July 1981. Final blasting regulations are to be published around January 1982. We suggest that OSM consider the following while developing new blasting regulations:

--Criticism of the studies supporting OSM regulations on technical grounds appears to indicate a need for more and better research. Additional research may be necessary on the effectiveness and cost of varying peak particle velocities and scaled distance factors. Research may also be needed on the impact of more powerful versus less powerful but more frequent blasts and the cumulative effects of continuous blasting over long periods of time.

--On the surface, OSM's proposed regulations published in the January 22, 1981, Federal Register, allowing some threshold blast damage, could reasonably be interpreted as conflicting with the act. Section 515(b)(15)(C) requires that injury to persons and damage to property be prevented. If some blast damage is inevitable or no blast damage is excessively costly to attain, OSM may want to ask the Congress to clarify the act's intent.

1/Threshold damage is the lowest level of blast damage; the others being minor and major blast damage.

BONDING REGULATIONS

While performance bonds have traditionally been required for mining operations, the bond amounts generally were not adequate to finish reclamation work abandoned by coal operators. Most States did not require sufficient bonding to complete the reclamation work. At least one State (Pennsylvania) did not even attempt to reclaim the land if the bond was inadequate. Also, unfinished reclamation work led to further environmental damage. To ensure the mined area will be reclaimed, the act requires bonds adequate for the State regulatory authority to complete the reclamation work.

With the more stringent requirements of the act and OSM regulations, bonding companies either stopped writing coal mining bonds altogether; limited their bonding to the larger coal operators; and/or required coal operators to pledge collateral, in some cases equal to the bond's face value, in addition to paying the bond premium. For over 2 years, OSM has been changing the bonding regulations to meet the bonding companies' objections. 1/ Yet as the Mining and Reclamation Council of America stated in a 1980 draft report, small- and medium-size operators are having an extremely difficult time obtaining bonds. In addition, a bond surety association official told us that no matter how the regulations are changed, small operators will continue to have problems obtaining bonds unless the act is changed.

The act does provide flexibility by allowing a State to implement an alternative system to bonding. The only alternative system we are aware of is a fund derived from a tax on coal production or permit application fees which may or may not be used with a bonding component. The fund is used by the State to complete unfinished reclamation work. To date, only West Virginia's program provides for an alternative system. West Virginia requires a $1,000 bond per acre and a reclamation fund derived from a 1-cent-per-ton tax on coal production.

In contrast, Pennsylvania requires a $4,000 per acre bond, and the bond amount will probably have to be doubled to comply with the act's bonding provisions. According to Pennsylvania's Department of Environmental Resources officials, requiring such a bond will put a number of small- and medium-size mine operators out of business.

1/Bonding companies dislike the act's sections concerning (1) the citizen's right to challenge bond release, (2) the State regulatory authority's right to increase the bond amount during the life of the bond, and (3) the bonding company's liability being extended to 5 to 10 years after mining operations cease.

The advantages of a separate fund with or without a bonding component are:

--State regulatory authorities can begin reclamation work quicker since the State regulatory authority will not have to wait for completion of legal action requiring the bonding company to pay off the bond. Pennsylvania's Department of Environmental Resources officials told us that it takes about 6 months to a year to complete the legal process, during which time severe environmental damage may occur at the mine site.

--Bonding companies might not be reluctant to participate in the program if it had a bonding component. Most, if not all, of the uncertainty associated with bonding under the act--bond duration, release, and amount--would be passed to the separate fund. West Virginia's Department of Natural Resources officials told us that bonding companies are willing to underwrite bonds in their State because of the State's fund.

--State regulatory authorities will not have to rely on the financial solvency of bonding companies to complete reclamation work. According to Pennsylvania's Department of Environmental Resources officials, funds were not available to reclaim a number of properties because a bonding company failed.

After evaluating the regulatory history of OSM's bonding regulations, it is apparent that OSM provided States little encouragement or incentive to adopt alternatives to bonding. Unless OSM takes an active role in encouraging States to use alternatives, the following may result:

--Small- and medium-size mining companies will be unable to operate without tying up significant financial resources.

--Lands for which bonds are forfeited after the act's passage (Aug. 3, 1977) and before the States implement their bonding programs, 1/ will not be fully reclaimed. The act provides funds only to reclaim lands abandoned before its passage and most States awaiting program approval do not require operators to bond to the full reclamation cost. Pennsylvania officials believe this will be a significant problem in their State.

--Mining's long-term effects will not be addressed. Once the bonding liability period runs out--5 to 10 years

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1/As of July 1981, the major coal-producing States have not implemented their bonding programs.

> after mining ceases, which the bonding industry already believes to be too long--any subsequent environmental damage will probably go uncorrected. For instance, subsidence (land settling) problems might not be noticed for years after mining ceases. Funds will not be available to take care of such problems unless a fund is available.

PRIME FARMLAND REGULATIONS

The act and OSM regulations provide for preserving prime farmland 1/ while allowing coal operations to continue. Overall, the impact of surface mining for coal on the Nation's agricultural production capacity is going to be relatively small. About 100,000 acres of land are surface mined each year, and most of this land is eventually returned to some level of crop production through reclamation. Conversely, about 1 million acres of prime farmland are permanently removed from production annually--about 80 percent through urbanization and about 20 percent through inundation by water projects.

While the disturbance of land for coal mining is not a major factor in withdrawing land from agricultural production at the national level, in some rural counties essentially the entire area is underlain with strippable coal. Obviously, surface mining for coal could have tremendous impacts, both physical and social, in such areas.

The act's provisions and OSM regulations set forth numerous design criteria which must be met by coal operators. We did not evaluate whether the design criteria were necessary to meet the act's objective of preserving prime farmland. However, we did focus on the following areas as they apply to preserving prime farmland:

> Coal operators exemption: Under the act, as interpreted by the U.S. Court of Appeals for the District of Columbia in May 1980, any mining operation with a permit approved before enactment of the act (grandfather clause) is excluded from the prime farmland provisions as long as the mining operation is the continued and contiguous operation of the same ongoing mine along its seam.

1/According to the U.S. Soil Conservation Service, prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oil seed crops, and also is available for these uses. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed (including water management) according to acceptable farming methods.

(In re Surface Mining Regulation Litigation, 627 F.2nd 1346, 1362 (D.C. Cir. 1980).) Illinois, which has the most strippable coal reserves underlying prime farmland, has two heavily worked coal seams which are continuous. One seam has been mapped as being 42 or more inches thick throughout an area of 9,269 square miles underlying 55 counties. This decision might be viewed as allowing a coal operator with a preexisting permit to continue mining along the seam by buying or leasing coal rights without complying with the prime farmland provisions because of the exemption.

Our concern is that the prime farmland provisions may not be effective in preserving prime farmland and that the exemption provides a competitive advantage to a "grandfathered" coal operator who will not have to comply with the more costly regulations. A legislative change may be needed.

Preventing alternative land uses of prime farmland: The act requires that prime farmland be restored to 100 percent of its premined condition. This can be costly. AMAX Coal Company estimated that for four mines in Indiana they expended $27 million in 1978 and 1979 to purchase equipment and $8 million in additional annual operating costs to comply with the act's provisions. Further it is not certain that prime farmland can be returned to 100 percent of its premined condition. If it cannot, the act prohibits mining. In either case--restored or prohibited--the land can be used for purposes other than farming, thereby reducing the act's effectiveness.

Traditionally, governmental control of land use has centered at the State and local levels, and we are concerned with how the Federal Government can protect prime farmland from being lost to other land uses by requiring strict restoration or prohibiting mining entirely. In a previous report, "Preserving America's Farmland--A Goal The Federal Government Should Support" (CED-79-109, Sept. 20, 1979), we noted that State and local governments have had a limited impact in preventing farmland conversion to other uses.

Once lands have been returned to premined productivity or mining has been prohibited, the land can be used for any other purpose permitted by the State and local land-use laws. Without a comprehensive policy defining the national importance of retaining prime farmlands, the act's provisions can do little to prevent losing prime farmland. A legislative change may be needed.

SEDIMENT CONTROL REGULATIONS

Unchecked sediment from coal mining operations can severely damage fishlife, water supplies and recreational areas and increase flood frequencies. Therefore, the act requires mine operators to prevent--"to the extent possible using the best technology currently available"--adding sediment to streamflows. OSM regulations, however, went much further by requiring mine operators not only to build sediment ponds to control sediment but by telling operators how to build the ponds. Based on coal industry challenges and subsequent court rulings, some of these regulations were suspended.

Comments concerning the OSM regulations in the sediment control area question the applicability of a rigid set of national requirements to the climatological, geological, and topographical conditions existing in various mining areas. Those commenting recognize the importance of controlling sediment, but argue that design criteria do not adequately address the differing environment of each coal mining area. We suggest that OSM consider the following concerns in developing new sediment control regulations:

--The necessity for a sedimentation pond at all mines and, if necessary, what size the pond should be.

--The potentially adverse environmental effect of having sediment levels lower than those which occur naturally.

These concerns are discussed below and show the limiting effect of arbitrary criteria.

Pond necessity and size: OSM regulations requiring a sediment pond at all coal mines 1/ may be unnecessary and limit regulatory authority flexibility. According to OSM, requiring a sedimentation pond at all coal mines is necessary because the pond is part of the best technology currently available for controlling the effects of sediment on streamflow. However, in the environmental impact statement accompanying the regulations, OSM cited previous Department of the Interior studies which showed "excess sediment from mine activities was not found in small streams that were more than two miles from the mined area." If sediment does not reach a streamflow, why is a pond necessary? Nevertheless, OSM regulations would still require a sedimentation pond at a mine no matter the distance from a stream.

1/The regulations exempt mines with a small disturbed area.

> We believe sediment ponds need to be considered as an option within a total sediment control system, with any pond needed being as small as possible to prevent the unnecessary disturbance of additional land. OSM sediment pond design criteria required the pond to be of sufficient size to detain the maximum amount of water expected from a 24-hour rainfall at any time during a 10-year period. However, the Environmental Protection Agency does not believe that information presently available allows tying sediment pond size criteria to a specific rainfall event. At this time, the Environmental Protection Agency is doing studies to help eliminate this information gap. In addition, there is the question of the rationale for using a 10-year/24-hour rainstorm requirement when the expected service life of the sediment pond may be less.
>
> Potential adverse environmental consequences: Decreasing the natural sediment level entering a stream may cause downstream erosion. Therefore, by establishing uniform performance standards, OSM may be adversely affecting the environment. All streams have a level which keeps them in balance with the soil in the area. If the natural sediment level is reduced, the stream will compensate by eroding its banks and bottom until a sediment level is reached. In brief, the limits established by OSM regulations can cause erosion by decreasing the amount of sediment reaching a stream below that level which occurs naturally.

Even if stream erosion did not take place, we believe little is accomplished by changing a stream's sediment level during mining operations. At the conclusion of mining, the land is returned to approximately its premined state. The natural stream balance--since it is based on site-specific features such as geology, soils, and precipitation--will re-establish itself. In many areas of the country this natural sediment level will be in excess of the arbitrary limit imposed during mining. The regulatory authority should not have to enforce uniform criteria with the knowledge of potential degradation and the future return to higher sediment levels when mining ceases.

GRAVITY DISCHARGE OF ACID WATER

About 11,000 miles of streams in the United States have been contaminated by mine-generated acid water. To avoid such contamination, the act requires mine operators to locate mine openings in such a manner to prevent natural (gravity) drainage of acid water. According to OSM and industry officials, this means up-dip mining (entering a coal seam at a lower portion of the slope and mining in an upward direction) is prohibited.

Pennsylvania's Department of Environmental Resources officials disagreed, stating that the act only prohibited the gravity discharge of acid water. The officials believe that mine openings could be planned in an up-dip manner when mine sealings would prevent acid water discharge.

Based on OSM's response to West Virginia's regulatory plan, we do not believe OSM would agree with Pennsylvania's position. Under West Virginia's State law, the Director of the Department of Natural Resources is granted discretion to approve up-dip mining if necessary for safety and environmental reasons. Because OSM believes the act prohibits up-dip mining, it is requiring West Virginia to change its law before unconditionally approving its regulatory plan.

The OSM Region I Director and Pennsylvania and West Virginia officials we contacted all agree that a site-by-site analysis is the best way to prohibit discharge of acid water and the up-dip mining method may be needed in some cases to prevent acid water discharge. The key factor in the analysis is how to minimize pressure on mine seals and natural geological structures. Without such an analysis, acid water can break out from a mine anywhere, not just at the mine openings. According to West Virginia's Director, Natural Resources Department, several major breakouts of acid water have recently occurred even though down-dip mining was used. Several millions of dollars will be needed to prevent further acid damage.

It would seem that acid drainage from coal mines is a serious environmental problem which must be addressed before mining begins. Given the diversity in terrain, climate, and physical conditions, it would seem pertinent that a site-by-site evaluation be made of the best method to prevent acid drainage. In some cases up-dip mining may be a better method to control acid drainage. If OSM finds that up-dip mining may be appropriate but cannot approve this method because of the act, then OSM needs to seek a legislative change.

EXCESS SPOIL 1/ VALLEY FILL REGULATIONS

Before the act, excess spoil was haphazardly dumped over mountain sides causing erosion, acid drainage, landslides, sedimentation, and water quality problems as well as the potential for loss of lives and property damage. The act and subsequent

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1/Excess spoil is generated by expansion of overburden material beyond that needed to return the land to its approximate original contour and by mining, which removes mountain tops. Mountaintop spoil is usually placed in valleys or heads of hollows.

OSM regulations were designed to correct these problems and therefore called for specific standards concerning site selection, controlled placement, drainage, configuration, and design.

OSM promulgated design criteria regulations which limited the methods coal operators could use in disposing of excess spoil. Subsequently, OSM contracted with the National Research Council to evaluate alternative technologies and regulatory practices for the disposal of excess spoil from coal mines. The study is to be completed in late summer 1981.

Based on our regulatory analysis, we suggest that OSM consider the following concerns in revising excess spoil/valley fill regulations:

--Stability safety factor 1/ of valley fills should be based on a site-by-site evaluation rather than a 1.5 factor to prevent unnecessary design and construction costs as well as to provide better safety for the public.

In an October 1978 study done for the Bureau of Mines, engineers and consultants, Skelly and Loy, recommended a safety factor of 1.1 for fills in remote areas and a factor of 1.3 if failure of a fill could cause property damage. Others suggested safety factors of 1.7 or 1.8. OSM believes the added degree of protection by the 1.5 safety factor is warranted to protect the environment and offset the lack of long-term maintenance over the lifetime of the fill.

Better safety may be assured by leaving the appropriate safety factor up to the design engineer who would design on a site-specific basis. We believe in some cases this would result in cost savings and in other cases a higher degree of safety. However, provisions would have to be made to notify the public about valley fills, should land use be changed in the future.

--Transporting excess spoil from the mine pit to the dump site can be very expensive. Mine operators should be given sufficient flexibility to use controlled gravity dumping rather than truck hauling of excess spoil material when it is less expensive as long as it can be done in an environmentally sound way. According to Skelly

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1/According to the Chief, Bureau of Mines Reclamation and Process Waste Control, a stability safety factor of 1.0 means that all forces on the valley fill are in equilibrium and anything less is unstable.

and Loy and OSM's Region II Director, a site-by-site evaluation is necessary to do this.

--The act may be unnecessarily restricting appropriate structures (buttresses) to prevent landslides when the toe of the spoil area rests on a downslope. The act requires using only a rock toe buttress to stabilize valley fills. Skelly and Loy and OSM Region I officials disagreed with this restriction. Skelly and Loy stated such a blanket ruling could create rather than prevent stability problems, particularly in steep slope, thin, overburden conditions.

OSM's Region I Director stated that such a restriction is unnecessary and can result in additional costs to the mine operator. Both Skelly and Loy and the Region I Director recommend a site-by-site evaluation to determine the most effective way to stabilize fills, including using rock toe buttresses.

COAL ACCESS ROADS

Poorly constructed and maintained roads cause erosion, sediment, and dust from the disturbed areas. One study 1/ showed that about 10 percent of the total surface area disturbed by mining consists of roads. Recognizing the damage caused by roads, the act requires mine operators to control or prevent erosion and sediment; pollution of water; and damage to fish, wildlife, and public or private property. However, OSM regulations attempted to tell the mine operators how to meet these performance objectives by promulgating numerous design criteria for constructing and maintaining roads. In May 1980 the U.S. District Court for the District of Columbia ruled in a memorandum opinion that the road regulations were invalid based on a technicality--inadequate comment period. (In re Surface Mining Regulation Litigation, Civil Action 79-1144 (D.D.C. unreported opinion filed May 16, 1980).)

Our concern in this area is whether it is necessary to promulgate detailed design criteria to meet the act's performance objectives for roads. Other OSM regulations already address the problems associated with erosion, sediment, and water pollution. For instance, regulations already require coal operators to prevent to the extent possible adding sediment to streamflow thus requiring erosion, sediment, and water pollution controls to be in effect.

In revising the road regulations, OSM needs to be cognizant of regulations already promulgated to prevent unnecessarily regulating mine operators.

1/Grim, E.C. and Hill, R.D. "Environmental Protection in Surface Mining of Coal" (1974).

LIST OF ORGANIZATIONS CONTACTED DURING THE REVIEW OF SURFACE MINING REGULATIONS

Federal agencies

- Office of Surface Mining Reclamation and Enforcement - Headquarters; Region I, Charleston, West Virginia; and Region V, Denver, Colorado
- Environmental Protection Agency--Headquarters
- Bureau of Mines--Headquarters

State agencies

- Pennsylvania Department of Environmental Resources
- West Virginia Department of Natural Resources
- Wyoming Department of Environmental Quality
- Colorado Department of Natural Resources

Coal Associations/Coal Companies

- Mining and Reclamation Council of America--Washington, D.C.
- Pennsylvania Coal Mining Association--Harrisburg, Pennsylvania
- Western Pennsylvania Coal Operators Association--Pittsburgh, Pennsylvania
- West Virginia Surface Mining-Reclamation Association--Charleston, West Virginia
- Consolidation Coal Company--Pittsburgh, Pennsylvania
- Atlantic Richfield Company--Denver, Colorado

Citizen organizations

- Environmental Policy Institute--Washington, D.C.
- Public Lands Institute--Denver, Colorado

Other organizations

- The Surety Association of America--Iselin, New Jersey (telephone contact)
- National Research Council--Washington, D.C.

Senator **Bumpers**. Our panel this morning consists of Rev. Kenneth Hogren, Blandinsville, Ill.; Mr. Robert Holloway, Arch Mineral Corp., St. Louis, Mo.; Mr. Richard Clemmons, Illinois Farm Bureau, Bloomington, Ill.; Mr. Michael Schechtman, the Illinois South Project, Inc., Herrin, Ill.; and Mr. Douglas Downing, Illinois Department of Mines and Minerals, Springfield, Ill.

I can't understand why all those people are from Illinois [Laughter.]

If all of you gentlemen will come forward and take a seat, you can just relax until we can find Senator Percy. He is on his way back from the floor.

Senator **Percy**. I must say when it comes to the kind of conflict of interest which I have today, it is quite apparent that there isn't any conflict as to where I believe I should be when there is something as important as this to the country and to the State of Illinois. The foreign aid and security assistance bill is a terribly important bill. But I was able to get Senator Mathias to carry on for me while I will be gone. We will move the panel right along. There is going to be a vote I understand at 12 o'clock. The leadership thoughtfully said they can extend it for a few minutes. They will give me a 5 minute warning. So I hope we can finish up and release all of you then before I have to go down to that vote.

Otherwise, we will lose another 20 minutes or so.

I do want to thank Director Harris very much, indeed for his staying on. He can have a place right now at the table. Why don't you go right on up and take the place right here with our panel?

I would like to welcome all of you on this distinguished Illinois panel this morning. I am confident that you can help address the problems that we face in achieving the essential balance between resource needs and agricultural concerns. I also would like to welcome any other concerned citizens from Illinois who were able to come to Washington to attend this meeting. Allow me to express to all of you my deep appreciation for your efforts to be here today.

Your dedication and commitment to build a consensus on this issue in the State, and your determination to work together until we can find some solutions, I think are terribly important. We have the biggest stake in the Nation, but other States have big stakes also. Whatever we do in the Federal system of government could serve as a model for other States, and I hope that we will come up with those kinds of answers.

Before introducing our first witness, let me say to each of you that you will have an opportunity, as you have been advised, to put your entire text in the hearing record for study by our Senators and by members of the staff. If you could speak for 3 or 4 minutes we can then use the maximum amount of our time for questioning. Certainly if you could respond directly to the points raised by Secretary Watt and Director Harris here today, that would be appreciated.

Our first witness, Rev. Hogren, is rapidly becoming a spokesman for the preservation of McDonough County. Rev. Hogren is presently the pastor of two rural churches, and chairman of the Illinois West Central Conservation Coalition, a new group of citizens concerned about enforcing the prime farmland regulations of the Surface Mining Act in a part of Illinois that is blessed with some of the richest agricultural land in the world today.

Those countries gathered in Cancun, many of them Third World countries, all they would need in their country is some of that land they wouldn't have to be in Cancun today asking for help from the nations of the world. Rev. Hogren, I look forward to your statement.

TESTIMONY OF REV. KENNETH E. HOGREN, BLANDINSVILLE, ILL., ON BEHALF OF THE ILLINOIS WEST CENTRAL CONSERVATION COALITION; ROBERT HOLLOWAY, DIRECTOR, LAND RESOURCES, ARCH MINERAL CORP., ST. LOUIS, MO.; RICHARD CLEMMONS, DIRECTOR, LOCAL GOVERNMENT, ILLINOIS FARM BUREAU, BLOOMINGTON, ILL.; MICHAEL D. SCHECHTMAN, THE ILLINOIS SOUTH PROJECT, INC., HERRIN, ILL.; AND DOUGLAS M. DOWNING, SUPERVISOR, DIVISION OF LAND RECLAMATION, ILLINOIS DEPARTMENT OF MINES AND MINERALS, SPRINGFIELD, ILL.

Mr. HOGREN. Senator Percy, on behalf of the Illinois West Central Conservation Coalition, I do want to thank you for the opportunity to be with you today and to share with you our concern about the new mine opening up in McDonough County.

The coalition was formed after a series of meetings sponsored by the League of Women Voters in McDonough County to address the land use issue that we now face. After those meetings had ended a group of citizens began meeting to discuss the use of agricultural land in our community. We are a community based on agriculture. There is no doubt about that. We recognize that in McDonough County.

As we began to study the issue we found there is a large number of ways that agricultural land is being converted to nonagricultural uses. McDonough County has a number of groups that are currently addressing many of those issues. The Farm Bureau and the Soil Conservation Service are just two of the groups that are already involved in conserving and preserving prime farmland in McDonough County. But as we studied the issue we found there was one major concern that was missing. No one was addressing the issue of land loss that is potentially there through stripmining and the new mine in our own county.

There has never been a mine in McDonough County to strip mine coal. So it is something totally new for our community and we are just beginning to learn what it means economically to have a mine, how to live with the mine, and how to encourage the mine to reclaim the land as it should be reclaimed.

When we first studied the act and learned the intent of the Congress and the Senate, we were very pleased and we felt that our land would be protected. In fact we felt we had very little to worry about because of what had already been done. But then we began to study the permit that was issued in McDonough County. We began to have doubts our land would in actuality be returned to full productivity.

While we studied the permit we noticed that the role that the SCS played had actually come about after the mine had already been permitted, that the evidence that they submitted before the permit was issued was in part inaccurate because they did not have the right information. That made us very concerned because if it appears the SCS didn't know what they were doing, how are we, as citizens to participate in the decisionmaking process and to make our feelings known.

The evidence submitted as productivity results also caused us some concern. Much of the evidence that was presented has to do with the southern Illinois soils and as you are well aware, central Illinois soils are very different and have very different problems.

Perhaps what caused us even more concern was when we learned the Illinois Department of Mines and Minerals had submitted a friend of the court brief opposed to the prime farmland position of the act. We began to wonder what exactly was going on in Illinois! Could we feel that we had no need to worry about the farmland in McDonough County?

We had no idea when we began the coalition that it would end up with me sitting here testifying to a Senate subcommittee. I am here because I want to find out more information and gain some assurance that we still don't need to worry. But as I sat here this morning, I guess my worries just haven't been addressed. I don't feel that we are asking for some blown-up contorted thing. What we are asking for is that the act be enforced as it was intended by Congress.

Senator Bumpers has expressed that intent many times in your absence. We are concerned about the grandfather clause, but not because that is an issue in McDonough County. Our mine is not going to be grandfathered. It cannot be. It is a new mine issued under the new permitting process. But we are worried about the process that is going on. For instance, this morning I heard that because of the amount of public input that was given for the rulemaking process they were going to wait and look it over carefully.

Then I also heard that they need more public comment. I have trouble understanding how citizens are going to participate in the process if they have so much comment they need to wait, yet they want to ask for more. We as citizens are concerned about a process that uses confusing methods of informing the public about what is needed. What more information are they looking for? We will be glad to supply what we can. We are also worried when we hear Secretary Watt talk about sacred lands. In my profession, when you use the term "sacred lands" it does draw up some emotional issues. I am not trying to misintrepret Secretary Watt because he has been misinterpreted several times, but that is an emotional word. Then Director Harris, in his testimony, says that they are trying to take emotional issues out of the whole ball game.

I begin to wonder what are they trying to do with us? They don't want us to get emotional, yet they want us to use technical data that we don't have access to. Senator Percy, let me close by saying that we are very concerned about the impact this mine is going to have in a very specific area, McDonough County. We hope that by testifying before you this day you will learn that we want our land reclaimed to 100 percent productivity as it was before the mine opened.

Thank you very much.

Senator PERCY. Thank you Reverend, very much indeed. Our next witness who will address the accomplishments of reclamation at the Captain mine, and within the the coal industry in general, is Robert Holloway of Arch Mineral Corp. Prior to joining Arch Mineral Corp. 6 years ago, he was Deputy Director of the Department of Agriculture.

I will put the rest of your introduction into the record to give you maximum time.

Mr. HOLLOWAY. Thank you very much.

My name is Robert Holloway and I work for the two most important industries in Illinois. They are agriculture and coal. I am a farmer. I live very close to Percy, Ill. Incidentally, Percy, Ill. is a honey of a place to live. [Laughter.]

Senator PERCY. Are you leaving those samples of honey?

Mr. HOLLOWAY. Yes, sir. I am. I would like to read into the record that my report to this committee is really a report of cooperative effort.

I am very much appreciative of the outstanding cooperation that I have received from the U.S. Department of Agriculture, the Soil Conservation Service, the Extension Service, the professional help from the Office of Surface Mining, technical staff as well as Department of Mines and Minerals. Way back in 1976, Senator, before your amendment was even sponsored I accepted a reclamation challenge from an outstanding coal president, Mr. Gerald H. Patrick. We stood in the pit of the largest land mobile piece of equipment in the world at the Captain Mine. It is illustrated in the photograph up here. Mr. Patrick wanted me to start growing corn during the next year (1977). Thanks to this cooperative effort and thanks to some very skilled members of the United Mine Workers organization, prime farmland, unknown to us at that time, was developed.

I am very pleased to report to you that since that time, I have grown corn, wheat, alfalfa, soybeans, peach and apple trees, 24 different varieties of French hybrid grapes and annually produce three tons of honey, all on reclaimed land. Next year we are going to start developing wine.

Senator PERCY. Can you give us an estimate as to what your yield in bushels is, corn for instance?

Mr. HOLLOWAY. Yes, sir. I will give it to you next. I want to read into the record, however, that I will not produce wine for you until it is time. [Laughter.]

Each year yields have increased. In 1981, under the supervision of Dr. Joe Jones, soil scientist from Southern Illinois University, the corn averaged 129 bushels per acre and soybeans 35 bushels per acre. During the next 3 years under the Experimental Practices section 711 of Law 95-87, Dr. Jones will be looking into the possibility, and I think this is very exciting, of mixing organic materials with the clay based subsoil to actually create new topsoil. I am going to predict that he is going to be successful. I think that his objective and our objective and your objective are very compatible. These objectives are to evaluate the soil replacement methods as a way to reduce reclamation costs and still maintain or improve the food producing potential of mine soils.

Since 1977, another eminent soil scientist, Dr. Ivan Jansen, from the University of Illinois, and his colleagues have been working on reconstruction of soils, not only at the Captain Mine, but at other sites in Illinois. Currently Dr. Jansen is mixing different horizons of soil at the Captain Mine with the very unique Bucket Wheel Excavator process. This system is the first in Illinois and the United States.

Dr. Jansen's yields throughout Illinois have ranged from zero to 155 bushels of corn, from zero to 41 bushels of soybeans.

I am submitting for your review and the staff three scientific papers in which he is concluding that there is evidence to expect that post-mining soils carefully constructed by blending selected subsurface horizons to dilute or favorably amend undesirable material will eventually be superior to the natural soils in some areas.

Further work is needed. This work has begun.

We at Arch Minerals certainly believe in sound reclamation and the principles of Public Law 95-87. However, I do think it is counterproductive to have unreasonable time constraints for productivity. Case in point. Somebody needs to decide on the definition of contemporaneous. I don't think we should ask our own wives to work in our yards and rose gardens under unfavorable agronomic conditions. There are times when we have to reclaim land (by law) whenever the conditions are not favorable to the total productivity of that soil.

I would ask that your committee look into this word contemporaneous. On a site specific basis give us the time to maximize the productivity of that soil. I also think that we need to develop reasonable productivity tests for our industry. Even at this late date, when everybody is asking can we reclaim mine land to prime farmland, I would like to answer the question yes. I need to know, however, the bushels, or the pounds, or other tests of the regulatory authority in order to determine prime farmland productivity.

At this late date, we in the industry do not have the answers from the regulatory authority.

In summary, I would like to say that I truly believe that there can be compatibility with those having interests in agriculture and energy. We Americans now control approximately one-half of the total feed grain supplies of the world, two-thirds of the soybean supplies of the world, and I think we have more coal than all of Asia, Europe, South America, and Africa combined.

I commend your efforts, as I have heard you speak in your opening remarks, that we need to support greater export markets for agriculture and certainly for coal.

On behalf of our president of Arch Mineral, I would like to invite you and your staff, other members of this congressional committee, or members of this panel to come down to the Captain Mine and see coal mining and reclamation that is carried on simultaneously.

Thank you, Senator.

Senator PERCY. Thank you, very much.

I am going to ask you to give us an explanation, if you would, of the reclamation photos that you have put up here, Mr. Clemmons of the Illinois Farm Bureau possibly could give us a little more information—let's turn this so we can actually see it. Maybe we can just go through the process, if you could, right here.

Thank you.

Mr. HOLLOWAY. Yes, sir.

Senator PERCY. That honey bear is quite a pointer you have got there. [Laughter].

Mr. HOLLOWAY. Produced at Percy, Ill.

Right here is the actual production of the coal, which is open cast mining. This is the same type of mining that has been carried on in Illinois for the last several years. However, this reclamation system here is quite unique. This is our giant mixmaster. My explanation might be comparable to Betty Crocker baking a cake. You can see right down here (pointing to picture) that we have the ability ahead of mining to mix different horizons of soil. Through testing at the University of Illinois and Southern Illinois University, we determine our soil horizons mixtures.

Senator **Percy**. Can you hear in the back?

Mr. **Holloway**. We are now able to change the physical and chemical structure of the soil in a sense that we are actually producing a brand new soil.

Senator Percy, by the test of the U.S. Department of Agriculture and by the definition, we have discovered land right here [pointing to picture] that is not prime farmland. With this new system, we have changed the chemistry and have produced prime farmland after we have removed two seams of coal.

Over here [pointing to picture] you can see a brand new field. This is our spreading equipment. The ground pressure of this equipment is one half of your human body. We are very concerned about compaction. You can see we are reclaiming it back to the original topography. This is the actual photo of the land that we are growing the crops on that I have already described.

Senator **Percy**. Could I ask you this question:

When you convert nonprime farmland to farmland afterward—only God can make a tree, but you can make better farmland—what is the change in value from the previous evaluation to the post-reclamation value?

Mr. **Holloway**. Agriculture land right now in our county is running about $2,000 an acre.

Senator **Percy**. Before and after, though, what is the comparison of change when you convert it to prime farmland?

Mr. **Holloway**. I would say it would probably increase because I am predicting now crop yields will increase in productivity. This is what our tests are showing.

Senator **Percy**. Perhaps Mr. Clemmons, you could just start right in on your own illustrations right here.

Mr. **Clemmons**. Those aren't my illustrations.

Senator **Percy**. Can we all see this chart here, the picture?

If you can give us the illustration of what you have done here?

Mr. **Clemmons**. Senator Percy, I believe these are the Department of Mines and Minerals' photos. So they would be part of their presentation.

Senator **Percy**. I see. Why don't you go ahead then, Mr. Clemmons?

Mr. **Clemmons**. Thank you.

I am Richard Clemmons from the Illinois Farm Bureau, in Bloomington, Ill., and I won't cover all the points that we have included in our written testimony. But I would like to begin by commending Senator Percy on his interest in the preservation of our main natural resource in Illinois; that is our prime agricultural lands.

It is obvious the conflicts that sometimes exist between Illinois farming and the coal mining industry when Illinois is almost two-thirds underlain with recoverable coal. Just some reactions to some of the points that have been made regarding the implementation of the Federal act in Illinois. First of all, our organization has basically been one that has felt that broad reaching laws should be implemented with people who have some expertise in the area for the State and in our case, Illinois, and that basically we do agree the Federal Government has a role to play in an issue like this congressional action regarding surface mining in 1977 and the prime farmland section of the act is something we agree with.

We have successively had stronger reclamation laws in Illinois to the point where we are physically reclaiming to grow crop agricultural capability. The Federal act goes one step further and actually provides for productivity on the soil for determining whether it meets the equivalent yields or not.

We agree with that particular segment of it.

Our one great concern right now is regarding the grandfathering aspects of the legislation and subsequent program in Illinois and the deletion of the date by the Office of Surface Mining.

We feel that it was the intent of Congress to have everyone comply with the Federal mandate at some time and that we started with the reclamation process, the proof of Productivity at some date.

We agree with the Illinois Department of Mines and Minerals when they suggested that we have a cutoff date where everyone would begin to reclaim under the same standards and we will be making comments into the record to the Office of Surface Mining to that effect, now that they have begun to request comments on that particular subject.

I would like to address one thing that is really a peculiarity to the State of Illinois dealing with this matter; that is, at the time of passing enabling legislation in Illinois, there was a clause inserted into our act that said that we can be no more stringent than the Federal act and the Federal program. Obviously, the Federal act requires the States be no less stringent.

I feel, and our organization feels, that if we retain that language in our State act—with our organization we will try to delete that language, by the way—then any subsequent deletion or slightening of the Federal program through the Office of Surface Mining will either have an effect on the Illinois program or we will be subject in Illinois to court tests by the mining industry, regarding that particular, more stringent section.

So I feel that Illinois has a peculiar problem, and I believe other States have the same thing.

Second, regarding the grandfathering there was some discussion, and I think in Director Harris' comments regarding the fifth amendment. We are familiar that the Supreme Court has said that the prime farmland section is constitutional. I am not an attorney, but I believe that through subsequent stronger State laws in Illinois, to my knowledge, there has not been a challenge regarding stronger reclamation standards. I feel that in this case we should continue with the grandfathering date and see what happens with the program; let the courts decide the issue. That is where it ends up.

Senator PERCY. I am sorry. I will have to interrupt you, unfortunately. I have been notified by the leadership that I have 3 minutes to go down to the floor to vote and I will be right back.

We will recess for about 6 minutes, then.

[Brief recess.]

Senator **Percy**. Because we do have another vote fairly soon, we will just keep moving along and hope to finish before that vote comes.

Mr. **Clemmons**. I will wrap it up very briefly and call your attention to the more detailed submitted statement for the record.

One of the things we would like to address in closing is that we will have a significant amount of coal, coal resource development by underground mining methods and our greatest concern is that there will be several thousand acres of prime agricultural land affected by subsidence sometime in the future, the actual dropping of the land.

Thus it will affect such things as drainage tile and natural drainage of the farmland and reduce its productivity.

Underground mining and the effects of the surface are addressed in the act.

We feel that that section should be fully implemented and that we should continue our efforts to find answers to subsidence problems on agricultural land.

We would urge that Congress, and specifically you, Senator Percy, continue your efforts in that regard.

We would close our comments with that and commend you for all you do on behalf of Illinois agriculture and getting at the issues and also on behalf of finding good energy sources for us.

Thank you.

Senator **Percy**. Thank you very much.

I wouldn't want to fail to have you say that last. [Laughter.]

I would like to note, Mr. Clemmons, that in addition to your responsibilities with the Illinois Farm Bureau, you have served on the Citizens Advisory Committee in the Abandoned Mined Lands Advisory Council and Illinois Department of Mines and Mineral Advisory Council, expressing the Agricultural Committee's concerns about the local reclamation projects and Federal surface mining policies.

We very much appreciate your contribution.

Our next distinguished witness is Michael Schechtman, Illinois South Project, well-known expert on the issues relating to increased coal production and the maintenance of prime farmland.

Mr. Schechtman and the Illinois South have been reviewing the implementation of the Surface Mining Act for the past several years. He and his colleagues have focused on the development of regulations and public information programs. I am also interested in hearing what Illinois South has to say.

I know you speak for a great many people in our State who share your own very deep concerns. So, Mr. Schechtman, if you would be good enough to offer your testimony.

Mr. **Schechtman**. Thank you, Senator. I appreciate the opportunity to be here today to be able to speak not only on behalf of Illinois South Project, but also on behalf of county officials with whom we work in southern Illinois, and groups throughout the State that are concerned about the prime farmland issue.

In my formal testimony that is being submitted for the hearing record, I touch upon a number of specific problem areas related to the proper protection of prime farmlands; however, in light of time constraints, I would like to focus my oral comments on some of the remarks made earlier today by Secretary Watt and Director Harris.

I feel there was an impression given that the Surface Mining Act in itself, both in terms of its passage and its subsequent implementation has been a major barrier to coal production in the country. Coal production statistics tell a very different story. In 1976, the year before the act was enacted, the total coal production for that year was 689 million tons. According to the Department of Energy, in 1980, annual coal production for the United States had risen to 835 million tons.

The October 1981 issue of Coal Age magazine reported the following:

> Coal production continues to out-perform the overall economy. In the week ending August 29, coal production reached a record level of 19.3 million tons and U.S. railroads hauled more coal than in any week since 1926. Conversely, the national economy has looked a bit sickly lately.

We know that regulatory reform is going on and regulations are being rewritten; however, most of these new regulations have yet to be implemented. So I think the coal production increases we are seeing have nothing to do with the lifting or changing or weakening of regulations, or whatever the allegations are about the regulatory reform movement.

One of the comments made earlier that disturbed me, and I thought was problematic, was the inference that regulations were being rewritten because of tremendous inconsistencies between the regulations and the act; but in actuality, over 90 percent of the regulations that were litigated have been upheld by the courts as being consistent with the act.

An awful lot of time of the public, the coal industry, and the Federal Government, and an awful lot of dollars already have been expended in extensive litigation. We are concerned that we are going to be spending a lot more of our time, the industry's time, and the Government's time, fighting in the courts over the regulations that are now being rewritten.

We hope that this won't be the case. We are not sure, however, why all of those regulations that have already been upheld as being consistent are now being rewritten.

I find myself in an unusual situation where I will have to go back to Illinois and report to my colleagues and other people that I am in full agreement with one of Secretary Watt's policy positions; I hope that my credibility will not be strained. I am sure the transcript will have the words more accurately than my notes; however, I wrote down that Secretary Watt said something to the effect that "if the operator cannot restore prime farmland to its full productivity, he cannot get a permit for mining. That is what the act says." We are in full agreement.

Secretary Watt is also a lawyer. He understands the implications and the importance of the fine print. The fine details of how that determination is made is where the problems are.

I think we are in full agreement with the policy position stated by Secretary Watt. We have no argument and we appreciate his support of that broad policy. We have problems about how the coal operator makes that technological determination. My written comments incorporate technical information and detailed analysis on this issue, all of which is being submitted to the record, so I don't want to take time now to go through a lot of those details.

One other area that was discussed at great length this morning was the whole matter of the grandfather clause.

The statement was given, and I think it is an accurate statement, that there is no explicit basis in the act for a cutoff date per se. Unfortunately, I think we have to agree with that. We cannot find a specific date, per se. We also can't find in the act that there is any basis for allowing prime farmland to be grandfathered indefinitely in the future.

I think the legislative history, the act, Senator Percy's efforts, and Senator Bumpers' efforts, are all very clear about the need to protect the prime farmland from being grandfathered indefinitely.

There were comments made by Director Harris regarding the question of a cutoff date as having a problem with respect to constitutionality; whether there is a "problem of taking under the Fifth Amendment."

Well, the constitutionality question of taking is not a matter per se of when the taking happens, whether it is next year, in 2 years, or in 5 years. The date itself is not the issue. The issue is whether the performance standards constitute a taking. Why we can't get a cutoff date, I still don't know.

Illinois South is very concerned about the comment that was made by Director Harris in response to a comment from Senator Bumpers. I do not have the words, exactly, but the suggestion was made that if 20 years in the future, land that was owned by a coal operator had been grandfathered, it could still remain grandfathered and not have to be reclaimed to the full provisions for prime farmlands. The response was that, well, if it was owned by the coal operator, it would still be grandfathered, and Illinois South Project finds that response to be very troublesome. That is why we need a cutoff date: the regulation that was issued in no way is adequate to address the problem.

Bob Holloway did a fine presentation. As always, he is an excellent spokesperson for his company.

Nevertheless, there is a matter that needs to be made clear for the committee and for the public; that is, the location of his company's mine is in southern Illinois, and contains very different soil types from those found in central Illinois, where in particular Ken Hogren was raising questions about McDonough County.

We do have prime farmlands in southern Illinois that have the soil problems identified in the research of Dr. Jansen that in fact could be reclaimed and possibly improved by proper reclamation.

However, Dr. Jensen referred to central Illinois as having soils that in their own undisturbed state have "nearly ideal properties." One does not have the opportunity to try correcting soil problems during the mining and reclamation process."

In light of the time considerations, I will stop at this point in my testimony, except to add that a number of people from Illinois asked that I invite both Senator Percy and all the members of the committee to continue this dialog in Illinois with a field hearing, so many of the people who would like to have been here today would be able to meet with you and present their concerns.

Thank you, Senator.

Senator PERCY. Thank you very much indeed.

Before we have our final panelist, Mr. Downing of the Illinois Department of Mines and Minerals, I would like to say, Mr. Downing, that you have supervised the Division of Land Reclamation, an enforcement agency. It is an important agency for the reclamation in the State. I think Illinois has done a traditionally excellent job in striking a balance between a resource development objective and environmental concerns. Your work on surface mining is no exception to that. That is the kind of balance that I know Director Harris and Secretary Watt have spoken to us about.

Before you testify, possibly you could join us, and I would like to have a picture of us showing where the prime farmland is with coal under it in the State of Illinois. Maybe we can just come up to the—Mr. Schechtman, maybe you can join us up here, and Reverend Hogren, if you would be good enough to come on up, and Doug Downing and Director Harris, if you could come up here. I would like to preserve this for posterity; actually have you demonstrate and show us where this prime farmland is in Illinois with coal under it.

Mr. Downing. Senator, in Illinois, this map of Illinois indicates in green the areas where the surface is underlain by coal.

Senator Percy. In other words, It covers this entire area.

Mr. Downing. Roughly the southern tip of the State.

Senator Percy. About two-thirds of the State.

Mr. Downing. Most of that area is also overlain by prime farmland, soil types. I would say roughly 60 percent of the area in green is overlain by prime farmland, soil types.

Senator Percy. If you can get a picture of all of our colleagues over here, be sure to have all of us.

Mr. Schechtman. Would it be helpful to point out what part of the States have those concentrated and hard soils, and what parts don't have those same characteristics?

Mr. Downing. The southern—probably the southern third of the State, some of the soil types in the southern third of the State has this problem Mike spoke of, and I expect that, not being a soil scientist, I would say about Madison County through Fayette, Bond, Fayette County, Montgomery, Shelby, Cumberland, Clark, somewhere in that neighborhood.

Senator Percy. OK. Fine.

Mr. Downing, why don't you start in? Regrettably we are working against that clock. We have another vote on. Your full comments will be incorporated first in the record.

Just do the best you can to summarize it.

Mr. Downing. Thank you, Senator.

We truly appreciate the opportunity to come here today and speak to you and to give you some thoughts on our program. Also, I thank you for your remarks about Illinois's past surface mining land reclamation program.

I was personally very interested to hear you and Secretary Watt speak of a balance. We have, in Illinois, as you stated, previously tried to strike that balance. We hope to do so in the future.

Generally we support Secretary Watt's and Director Harris' attempts at regulatory reform. We believe that if the operators are provided an opportunity to have the target to shoot at, not be told how to reach that target, that they will be able to mine, produce coal and conduct the reclamation operations at somewhat reduced costs, but it will also force—maybe force is not the proper word—but they will have an opportunity to innovate and find ways, new technology, to help them meet those preformance standards.

Generally, I guess one subject we need to speak of today that we have had some comment about, and that is the grandfather clause, and where does Illinois stand on the grandfather, or the end of the grandfathering? As everybody is probably well aware, the 1982 date originated in the Illinois Department of Mines and Minerals with my predecessor and subsequently was adopted by the past administration and subsequently dropped by the current administration.

As I said before, we generally agree with Secretary Watts and Director Harris's regulatory reform. However, that is one change in regulations that we do not agree with and we intend to, and have notified the Justice Department that we intend to amend our complaint concerning that issue in the Federal District Court in Washington.

Basically, that is my statement for today. There are a number of statements that were made that are too numerous for me to try to cover in the short period of time I have. So I will stop there.

Thank you, Senator.

Senator PERCY. Fine. Thank you.

I think we can begin our questioning and then we will have to suspend for a few minutes while I go down and vote and come back.

Director Harris, I will leave it entirely to you. I would like to have you give a response if you would like to at this time.

The panel has finished You can go, and be excused, or if you prefer, wait through the questioning and then give a final response—I will leave it entirely up to you.

Mr. HARRIS. I would like to stay through the questioning.

Senator PERCY. Fine. Thank you. That is very good indeed. We appreciate it very much indeed.

Reverend Hogren, let's start with you. So far we have heard much about the tradeoffs involved in developing domestic energy reserves, as well as some of the accomplishments that have been made in the reclamation techniques over the past 5 years. In your opinion, what does mining have to do to become more compatible with agriculture? What are the major questions which still need to be answered? What can I do to work with you to bring together these two tremendously important industries, vital, absolutely vital for our economy in Illinois, as well as the Nation?

Mr. HOGREN. Senator, as I see it, if the mining industry follows the rules that the act proposes—in other words, if the industry can reclaim the land to within 100 percent productivity, the same as it was before they mined, I don't see that conflict of interest.

When it comes to the issue of tradeoff, if you are using that term to mean we have to trade off some percentage of productivity, for example, that we should only reclaim it to 70 percent of productivity, I don't see where the act allows that. We talk about tradeoffs and incompatibility, but yet the act, in certain ways, does not allow for that. It says that where they cannot prove in a written statement that they can reclaim the land to 100 percent productivity, they will not receive a permit. We heard that statement reaffirmed earlier.

So I do not see it as an issue. I think if they can reclaim the land to full productivity they are very compatible and we would welcome mining in our area, but they have to meet that requirement of the act.

Senator **Percy**. I am sure you agree that coal production is important to the economy of Illinois. It is important to the economy of the Nation. Greater domestic use of coal can help reduce the very dangerous reliance we have now on imported energy, while also stimulating exports, create jobs in Illinois, and help reduce our trading deficit with trading partners such as Japan.

When I hosted the King of Spain at a luncheon a few days ago, I thought I would never talk so much about coal. But they have placed the first contract ever placed by a European country for coal, as I said, from Illinois. They intend, I am sure, to move forward with that and set an example for other countries. In your view, how might we best balance the need for coal, jobs, and energy with your concerns about the less desirable impact of surface mining?

Mr. **Hogren**. Once again, speaking from our experience in McDonough County. This past year Pioneer Seed Co. has opened a new seed corn plant just about 12 miles from where I live. They project that plant will supply 75 to 100 full-time jobs and during the summer detassling season, and fall sorting season, it will supply approximately 1,500 to 2,000 additional jobs for young people, students, and other citizens who are looking for employment. That employment is permanent. It is not going to end in 15 years. I see agriculture providing the economic basis for our community. Now where the coal industry can come in and meet the requirements of the act, we welcome the jobs that they will provide in our community.

Once again, we are looking for the acknowledgement that our community is based on the economics of agriculture, not mining. That just is not our primary source of economics in our county.

Senator **Percy**. I want to assure you that my goal is not to change, and my position has not changed. I see no reason, from everything I have learned and know, to change the fact that 100 percent of reclamation must be the requirement for prime farmland.

That should be, and must be what we are shooting for. I think at this point it would be best to recess—that is the warning bell—we will recess until I get back from the floor.

[Brief recess.]

Senator **Percy**. We will try to keep our questions brief and answers concise.

You can expand any of your answers for the record. We will try to finish before the next vote.

Mr. Holloway, I do wish to commend the efforts at the Captain Mine in achieving quality reclamation.

The issue of grandfathering has received increased attention since the suspension of the deadline by OSM. We have heard today several positions on what continued grandfathering means to the State of Illinois. I am sure you agree with me that we need some deadline. Do you have any suggestions as to a sensible resolution of this issue?

Mr. **Holloway**. Yes. I certainly do. Thank you for those kind compliments.

I think I should set the record straight. Early after Public Law 95-87 became law, the mining that we were just talking about with this reclamation equipment was issued a closure order. It had limited effect on Percy, Ill. Apparently we were a test case. The inspector said we were creating imminent danger to the environment and we had not proved that we could reclaim the land back to the original productivity.

This wasn't a requirement under the Illinois law, but he was suggesting in the interim regulations that that provision superseded the Illinois law. We became a test case.

In the next 50 or 90 days, meeting with lawyers from our company, lawyers from other regulatory agencies, some lawyer—and I have a great respect for lawyers, but perhaps they had not the precise knowledge of a farmer, especially when we are talking about the creation of better soil with this opportunity in mining—pulled this number out of the air, August of 1982. That became a target for other States.

There is no scientific data to say that August of 1982 is magic. I would suggest this, Senator: It took you and your colleagues a lot longer than 5 years to pass this act, and I think we in the industry need the same amount of time to continue the research, to make sure we are not creating a soil that would be even less productive.

I think this will be substantiated by the scientific journals that I have presented to you.

Second, I am very concerned about the next prime farmland permit that is required unless, Senator, your staff, your committee, or some regulatory authority can tell us in the industry what does 100 percent productivity mean? At this date, even though we have demonstrated we have grown crops, I cannot get a release of bond. No one can tell me if it is pounds or bushels, or if I should be growing cotton or corn, or the rotation of any of these crops. Until we of the industry know that, it is most difficult for us to say that, "I think that we can do this," and then we have to demonstrate our ability and capability of getting a new permit under the full implementation of Public Law 94-87, which is prime farmland; we are hard pressed.

In Illinois, Senator, you have a very outstanding law, 1104. It is even more stringent than your amendment, more stringent.

In this period of the grandfather, 1104 does exist. I think that I have submitted to you enough scientific data that whenever you say the grandfather starts, we will receive a variance to mix the B and C horizon in the soil, put the A horizon right back. So by extending the grandfather in Illinois, we are going to do exactly the same thing we are doing today and tomorrow and 5 and 10 years from now.

Senator PERCY. Thank you.

If any of you that are here could answer, would like to provide an answer to the questions you have left dangling here, let's keep the record open for that purpose. So a written answer can be submitted.

Finally, just very quickly, when you consider that Arch Minerals has spent almost $1 million funding reclamation research at the University of Illinois and SIU, what aspects of research remain to be addressed about the most desirable ways to achieve quality reclamation?

Mr. HOLLOWAY. Let me set the record straight. The $1 million is certainly in error. The grant to the University of Illinois is a consortium of several coal companies in Illinois as well as the Illinois Farm Bureau. I commend their efforts in these times of fiscal restraint that the research that Dr. Jamsen can continue.

What Dr. Jamsen and the research is indicating that still needs to be done, we don't know how deep is too deep. We do not know the proper mixes when we had this opportunity to maximize yields, but we do know this: We have developed a brand now soil. We have manufactured soil. We changed the chemistry, the texture. It is very young. It is most difficult to compare a youngster and first grader in a race with a mature college athlete.

We are only suggesting that maybe even the test of productivity, that particular point should be considered when we compare this new soil with the brand new pure soil.

In the case of Upland, Ill., I think that there is indication and research that I have submitted that it would be advantageous to mix the B–C horizon, even on the dark prairie soils. I am sure this research needs to be continued even up there.

Senator **Percy**. Thank you very much indeed.

Mr. Clemmons, with the reorganization of OSM, the technical support staff will be withdrawn from the State; district and regional offices providing the support will be consolidated into two technical centers located in Wyoming and Pennsylvania. The new State offices will no longer have at their disposal soil scientists, hydrological engineers they previously had.

Do you have any concerns about his?

Mr. **Clemmons**. I would say we do have some concerns about that, Senator, because our organization has always been the one that has felt that even with a strong Federal mandate in an area such as this, that the State should have the job to implement the program and get it done, yet there are some areas where a Federal agency could provide the needed expertise or monetary assistance, or whatever, in dealing with some of the problems involved.

We feel that in this case that would be a very advantageous thing to do with the Office of Surface Mining, where it is necessary and although I wouldn't say that we are the experts in Government reorganization and all of that, there needs to be some kind of input and assistance by the Federal Office of Surface Mining to the States when they don't have the ability to do the job themselves.

We need to identify those and if necessary place those in the right position to do the job.

Senator **Percy**. Could you tell me what Federal or State actions are most important to protect the interest of the farm community without needlessly burdening the coal industry?

Mr. **Clemmons**. I didn't hear the first part of the question.

Senator **Percy**. Can you tell me what Federal or States actions are the most important to protect the interests of the farm community without needlessly burdening the coal industry?

Mr. **Clemmons**. I think we identified early in my testimony one of the things that we are very concerned about is for our statutory language; its ability to effect the Illinois program. This deals basically with the State act itself. Our State act says that we can be no more stringent than what the Federal act or program is. Yet the Federal act basically requires the State to be no less stringent. That leaves us no parameter to deal with problems peculiar to Illinois.

We have to basically mirror what is required by the Federal act; those differences in the statutes and the programs.

So I would suggest that that is an issue Illinois will have to deal with through the State legislature and basically delete that language so we can be more flexible ourselves.

Senator **Percy**. Mr. Schechtman, I wonder if you could supply for the record for us, not to take the time now, an answer to the same question I put to Secretary Watt this morning about the trade-offs we faced between energy resource development and environmental protection. I had asked for one or two examples where any environmental trade-offs are too steep; that is, where there is little to gain by way of energy supplies with too much of the risk to the environment, and likewise on the other side, an opposite example where the potential energy benefits are large and the environmental risks are small. Certainly if you would like to do that before you leave, we will provide secretarial help to you so you won't have to send it back to us.

[The information follows:]

ILLINOIS SOUTH PROJECT, INC.,
Herrin, Ill. January 19, 1982.

Hon. CHARLES H. PERCY,
Chairman, Subcommittee on Energy, Nuclear Proliferation and Government Process, Government Affairs Committee, U.S. Senate, Washington, D.C.

DEAR SENATOR PERCY: The following is my response to your question: Mine subsidence is a problem of tremendous concern to Illinoisans living in the state's coal regions. Inasmuch as 65 percent of Illinois is underlain by coal resources and the State Geological Survey has determined that some 88 percent of the coal resource will be extracted by underground mining, the potential disruption of the surface lands of Illinois by mine subsidence is staggering. A 1979 GAO report [1] noted widespread subsidence in Illinois, which, along with Pennsylvania, led all other states in incidents of mine subsidence. The report noted that millions of dollars of damages had resulted from subsidence in Illinois, and that present mining would lead to future subsidence.

Planned, controlled mine subsidence with its concomitant benefit of high extraction rates of the coal resource, holds important promise for minimizing, if not altogether eliminating, the negative economic and environmental impacts associated with unplanned, unexpected mine subsidence. Several companies are using just such mining approaches in some of their Southern Illinois mines, where the land surface is generally of a more rolling topography than the relatively flat fields of central Illinois. Additionally, there is great resistance by landowners to lease their land and allow planned subsidence because agricultural tiling has been put into most fields at great expense. Farmers know that their crop production levels will be dramatically reduced if drainage problems prevent farmers from tilling, planting and fertilizing fields at the ideal times.

I would support, on a controlled, experimental basis, the use of planned mine subsidence in central Illinois, in which total replacement of all damaged agricultural tilling and related drainage system components was required, and in which the re-establishment of surface drainage patterns that are fully compatible with intensive row-crop farm management practices is also required. If such an approach could be satisfactorily achieved for underground mines in central Illinois, we could move away from a situation in which 45 to 55 percent of the coal resource has to be abandoned and left behind, and move ahead to a situation in which 80 to 90 percent of the coal resource is fully extracted for utilization. In accordance with Judge Flannery's decision that all prime farmland shall be returned to prime farmland,[2] all the prime farmland acreage that potentially would be affected by planned subsidence would have to meet the demonstration of technological capability requirements under section 510(D)(1) of the Act and then return the affected acreage to 100 percent of pre-mining productivity. Without doubt, the energy benefits and the increased productivity for underground mines would be very large; the environmental risks are there, and they are more than just small. Nevertheless, I would advocate a careful, controlled exploration of this mining approach in central Illinois.

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[1] Alternatives to Protect Property Owners from Damages Caused by Mine Subsidence." Comptroller General of the United States. CED–79–25. Washington, D.C. February 1979.

[2] Flannery requested the Secretary of Interior to promulgate regulations to exempt specific surface facilities of deep mine operations which are small in size and which will be used over a long period of time. The Secretary has not yet promulgated these regulations but they clearly would have applicability to this situation.

On the other hand, I do not support, nor do the groups with which we work in Illinois, the allowance of coal operators to stripmine prime agricultural land in Illinois without having met the very critical pre-permit approval demonstration requirements of Section 510(d)(1) of the Surface Mining Control and Reclamation Act of 1977. Illinois South Project is very concerned that the Office of Surface Mining is going to take a very lenient and inadequate approach in seeing that this provision of the Act is carried out. One person in OSM told me that the Department currently is interpreting this to mean that the operator just has to have the necessary coal extraction and reclamation equipment. Illinois South Project has already stated in my prepared testimony that 510(d)(1) must be met on the basis of field data demonstrating the attainment of 100 percent of pre-mining productivity for mined and reclaimed prime farmland soils that are the same soils as the ones proposed in the permit application. Without such a showing based on field results as discussed in my prepared testimony, the permit should be denied, and the acreage should not be mined.

Senator Percy, thank you for your question and the opportunity to respond.

With best wishes,

MICHAEL D. SCHECHTMAN,
Staff Member.

Senator PERCY. Earlier today—you can answer now—I asked Director Harris to set a date about when the issue of a grandfather exemption cut-off will be resolved. You have been following this grandfather issue closely for several years and have been actively working for an established deadline. Because of the recent developments which have failed to establish the date, there is concern as to what this could mean to prime farmland in Illinois. From your experience on this issue, can you offer any suggestions on now to best resolve the conflict on the grandfather dilemma?

Mr. SCHECHTMAN. Senator, I think I would have to agree with Bob Holloway that the position that was adopted in terms of the August 1982 deadline is one that has problems in that there isn't a clear basis in the act for that particular date.

We felt that as a matter of trying to resolve what had become an increasingly convoluted and controversial issue, we could go along with the Department of Mines and Minerals' proposal particularly since that seemed to be the only politically viable game in town at that time. Our position, and it is one that has developed with input from a number of people beyond just the staff at Illinois South Project, is that if we could get OSM to go forward with rulemaking and get a rule adopted in the very near term, perhaps before the end of the year or soon thereafter, we would like to see the grandfather exemption end for States that are already approved and administering their permanent program 30 days after the new regulation has been adopted. For States that have not yet had their permanent programs approved by the Secretary, since there is an 8-month period in which permits have to be upgraded and brought into compliance with all the permanent program requirements, operators should have that full 8 months for getting grandfathered prime farmlands into compliance. At the end of the 8 months, all prime farmlands would have their grandfather status terminated, and operators would have to meet the full demonstration and performance standards for prime farmland.

Senator PERCY. I would like to say to all of you, I know there was some considerable interest in having this hearing in Illinois. It would be appropriate. I like to hold hearings there whenever I can. But in deference to Director Harris and Secretary Watt, we really felt it best for this first hearing to be here.

Mr. Schechtman, you have in your testimony issued an invitation to hold a field hearing in Illinois on prime farmland reclamation. I would really like to do so. I would like to give the State enough experience after DOI gives its control over to an approved program—then schedule such a hearing. They deserve to have enough time. Perhaps Mr. Downing could give us some idea of how long that would take, when would you feel comfortable in having a hearing scheduled, how long would it take, say, from now?

Mr. DOWNING. We expect our program to be approved some time the first part of 1982, senator. There will be an 8-month period before the permanent program performance standards become effective.

We would need some experience under those performance standards before such a hearing would be conducted.

It appears to me the best time for such a hearing would be the spring of 1983.

Senator PERCY. The spring of 1983 would be fine with me. I do think that from a practical point would be the most logical time.

Would Springfield be a good place to have that? Does anyone feel any different about that?

And, Director Harris, would it be possible for you to possibly be with us then sometime in that spring? We will check your calendar and set a date that would be convenient to you. We would like very much to have you out there.

Mr. HARRIS. As long as I am given adequate notice, I will be available.

Senator PERCY. We will give you plenty of notice on that.

I certainly do look forward also to having Mr. Holloway there a that hearing to give Illinois coal companies an opportunity to show the progress that they are making in the reclamation field.

I would like that progress to be reported right there in the capital of Illinois.

We have just a few more questions here.

We have another vote on. That gives me 7 minutes. Then we won't have to hold you.

Mr. Downing, we have the greatest respect for the job your Department has done in helping develop markets for the coal industry. Governor Thompson was down here yesterday. He spent time yesterday morning talking again about developing this whole industry; strategies on how we can best do it, how we can use my office as chairman of the Foreign Relations Committee to be the No. 1 export sales manager for all Illinois products, including coal, together with the power and influence of his office. We must do the best job we can to not only protect the coal industry, but to protect the agricultural interests of the State economy, which is a terribly important part of it.

Your Department will soon take over the surface and mining control program for the State. There has been some concerns raised about the Department's ability to take on this tremendous responsibility that the Interior Department will give to you soon. I would certainly like to hear your comments on whether you do feel prepared to meet the requirements of the act and at the same time satisfy the needs of both the coal industry and the agricultural community in the State.

Mr. DOWNING. Unequivocally we are prepared, Senator. We have done an interim program, probably one of the better jobs in the Nation of operating a program, developing a permanent program. Our resources have gone from about 12 people and a quarter of a million budget prior to the Federal interim program to somewhere in the neighborhood of 45 people and $1.1 million budget during the interim program and the permanent program, once the program is approved, we anticipate that our budget will be somewhere in the neighborhood of $2 million and approximately some 80 people. It is difficult to hire those people now when—to get all those resources, make those resources available now, when we don't have a program.

And with the current economic situation, the General Assembly is somewhat hesitant to appropriate those funds until they have a program in our hand.

So we firmly believe that we can operate the program. We have been working on strategies for implementing the permanent program, as some of the people have testified.

We have met on several occasions to assist them in preparing applications and preparing their strategies for the permanent program.

Senator PERCY. We may submit, on behalf of myself and other Senators, to the panelists any final questions that we might have. We will yield the balance of our time to Director Harris to discuss, if he would care to, the same questions the panel has been talking about, about the prospects for moving closer to a consensus among the many interested groups, as well as any other comments that you might have to make about what the members of the panel have said today. We very much appreciate your staying to hear their comments.

Mr. HARRIS. Thank you very much, sir.

I want to note that we sincerely came here today to hear the comments of all the interested parties concerning prime farmland. We intentionally held up the additional rulemaking until after the hearing. We were criticized in one case for that today saying that we were asking for more comment. That, very fortunately, is a part of the Federal rulemaking process. That allows the public to have proper input. I would like to thank you, Mr. Chairman, on behalf of Secretary Watt and myself for holding these hearings today and for your position for striking a balance between energy development and the protection of our farmlands and environment.

Today's testimony has been a significant contribution to my understanding of the issues and the problems associated with the prime farmland reclamation.

I look forward to working with you and your committee over the next several months, as we proceed with the operation of the Office of Surface Mining.

As I have indicated, it is my goal and personal commitment to you and your committee that we will assure that mining is conducted in accordance with the requirements of Public Law 95–87, and in a manner that assures proper protection for our important environmental resources. I have heard numerous comments from our panel, Senator Bumpers and yourself, on the cut-off date of the grandfather exemption. The testimony has convinced me that this rulemaking is important and I will commit to you today that I will continue to actively pursue this rule and to fully consider the comments raised today, as well as any additional comments submitted in response to this rulemaking.

As I have stated, our current schedule will allow us ample time to complete this process prior to the August 1982 date that previously was in the regulation. The questions of Senator Bumpers and the testimony of others here today has made it clear to me that there is some basic conflicts in the premises involved.

It is our assessment that under the extension of the prime farmlands provision, abuse of the grandfather exemption is not likely to occur. Our existing data indicates that the 13,000 acres of prime farmland under permit in Illinois today is the practical limit of the lands that would qualify for grandfathering under our existing rule, if no date were set. Thus we must reject any assumption that unlimited extension of the grandfathering exemption is likely.

Additionally, as I have previously stated, even these operations are subject to very stringent reclamation regulations. Section 816.116 (b)(1) of the regulations applicable to these lands specifically requires the ground cover and productivity of living plants on the regulated area within the permit areas shall be of living plants on the approved reference area or to the standards and other technical guides approved by the Director for use in the regulatory program. Thus as you can see, all mined lands will be held to a very high standard and to reduce the Nation's prime farmlands through mining is simply not possible.

It is my intention throughout the regulatory reform effort currently underway to fully consider all views and comments. My goal in undertaking to review of the cutoff date is to allow me to accomplish just that.

The testimony today has demonstrated the misunderstandings and conflicting interpretations on this issue.

I want to provide the public the fullest opportunity to have input into this process. I am distressed by the apparent inferences raised here today that the Office of Suface Mining should make a final determination on this rule prior to completing this public review process. As I have stated, and I am confident you will agree, we must keep the issues involved in perspective. The best approach to accomplishing this objective is through a thorough and complete airing of the issues through the administrative review process.

As has been testified to here today, we are very much in the Model T stages of farmland reclamation since such reclamation only started a few years ago. If we tie the mine operators to present technology in the reclamation of farmland, we are tying them forever to very basic methods that are available to us today. The forward-looking companies like Arch Minerals and many of the other operators that I visited, not only in Illinois, but in other States, indicate to me that there are better ways to do the prime farmland reclamation that you and we seek. For that reason, I have said in the past, and I continue to say, we have to allow some experimental practices in this area so that these better methods and technology can be developed.

It is not the aim of OSM under this administration to allow lesser reclamation of prime farmlands than you have provided for in the act. And we will not allow lesser reclamation.

I think that what the Office of Surface Mining has done with the regulatory reform, which has been questioned in some cases here today, should be applauded rather than have adverse comments made toward it.

Since my confirmation, I have, I think, visited nine coal mining States. In those areas, we have almost complete if not complete concurrence from the State regulatory authorities, from the mine operators and in many cases, environmental groups. I make it my business to talk with environmental groups as often or more often than other groups. Most of these various groups agree with us and I attempt to work with all these people before we make any great changes that affect their operation or their concerns.

We will continue in that manner. I think under this type of guidance and leadership that we will end up with a better environmental end product in an atmosphere of cooperation and assistance than could ever have been achieved in the adversarial atmosphere that was conducted under the previous administration.

Thank you, very much.

Senator PERCY. Mr. Harris, I thank you very much, indeed.

I thank every one of our panelists. We have a letter from Senators Jackson and Levin, members of the subcommittee, who expressed their deep concern and interest in the prime farmland issue.

I will offer you, Mr. Harris, a copy of that to take along. We will put that also in the record.

[The letter from Senators Jackson and Levin, the prepared statements of Messrs. Hogren, Holloway (with attachments) Clemmons, Schechtman, and Downing (with attachments) follow:]

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United States Senate
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, D.C. 20510

October 22, 1981

Honorable Charles Percy
Subcommittee on Energy, Nuclear Proliferation,
and Government Processes
Committee on Government Affairs
U. S. Senate
Washington, D.C. 20510

Dear Chuck:

We have followed very closely the implementation of the Surface Mining Control and Reclamation Act since its enactment in 1977. Although generally pleased with the actions taken by the Department of Interior's Office of Surface Mining, we are aware that problems have arisen in carrying out the law. For this reason, we recognize the need to improve OSM's regulatory program in order to facilitate mining of our nation's coal in an environmentally sound manner.

We are concerned, however, about the changes being made in the regulations which govern the surface mining of prime farmlands. More than 40 separate rules are being evaluated for possible revision, and some changes have already been issued in either proposed or final form. Of these 40 rules, three deal specifically with prime farmlands, and many others will affect the mining and reclamation requirements for prime farmlands.

The strong prime farmland provisions which you helped to make part of the 1977 legislation reflected the intent of the Congress that our important agricultural lands must not be needlessly damaged by surface mining. Such protection is even more critical today, as prime farmlands are being converted to other non-agricultural uses at the rate of more than 1 million acres per year.

We hope that the hearing you are conducting today will clarify the changes being considered in the prime farmlands regulations, and will assure us that the Office of Surface Mining intends to fully implement and enforce the prime farmlands protections of the Surface Mining Control and Reclamation Act. This is particularly important in view of the fact that the Director of the Office has publicly questioned the wisdom of the existing law.

Sincerely,

Carl Levin
Carl Levin

Henry M Jackson
Henry M. Jackson

CC: Senator McClure
Senator Warner
Senator Matsunaga

TESTIMONY

of

Rev. Kenneth E. Hogren,
Blandinsville, IL

before the

UNITED STATES SENATE
COMMITTEE on ENERGY and
GOVERNMENT REGULATIONS

on behalf of

the ILLINOIS WEST CENTRAL CONSERVATION COALITION (IW3C)

the CATLIN TOWNSHIP ZONING BOARD of APPEALS

the CITIZENS for the PRESERVATION of CATLIN, IL

the CITIZENS for the PRESERVATION of KNOX COUNTY, IL

Washington, DC
October 22, 1981

Gentlemen:

On behalf of the Illinois West Central Conservation Coalition, I would like to thank the Subcommittee for this opportunity to share several concerns about the enforcement of the Federal Surface Mining Control and Reclamation Act of 1977 (PL 95-87).

My name is Kenneth Hugren. I am the pastor of two rural United Methodist Churches located in McDonough County in Central Illinois. Recently I was elected Chairperson of the Illinois West Central Conservation Coalition (IW3C), a coalition formed on April 23, 1981, to encourage conservation of viable farmlands in McDonough and the surrounding counties of Central Illinois. The IW3C is a coalition of citizens who acknowledge the importance of agriculture in our community and our world. Paul A. Bucka, Exect. Vice President of the Land Improvement Contractors of America, has stated:

> "Agriculture is the nation's #1 industry. Taken as a whole, agriculture's assets come to $927 billion. That figure dwarfs even the U.S. budget, which this year will run about $655 billion"
>
> (Please see Attachment #1).

My organization, the IW3C seeks ways of preserving our nation's land resource which serves as the basis of agriculture - the prime farmlands. Citizens from a cross section of society are involved: farmers, lawyers, housewives, teachers, pastors and university professors, to name just a few. Today I speak to you as a representative of the citizens who have formed this new coalition and also as a representative of the Catlin Township Zoning Board of Appeals, the Citizens for the Preservation of Catlin, IL, and the Citizens for the Preservation of Knox County, IL.

Many of the people who are members of the IW3C were not acquainted with the issues which surround the preservation of prime farmland. Thus, one of the first tasks that confronted the new coalition was education. We learned that farmlands are being converted to non-agricultural uses at an alarming rate. (Attachments #2 & #3). Road construction, urban sprawl, erosion and surface mining for coal are all taking their toll of Illinois cropland. As we studied the issues in more detail, we were pleased to learn that other groups in McDonough County were already addressing many of our concerns. The Farm Bureau had helped develop and had lobbied for the IL Agricultural Areas Conservation and Protection Act of 1980 (Attachment #4). Soil erosion was being addressed by the Soil Conservation Service. The Northwest Chapter of Young Farmers was holding a program on on-till cultivation of crops. Churches were inviting Mr. Dick Weller, McDonough County Agriculture Extension Advisor, to present information on the family farm and its problems. But conspicuously absent was an attempt to understand the impact of the new Freeman United Coal Company's new strip mine operation in McDonough County. We believed that this potential loss of farmland needed to be brought to the attention of the community. First, however, we needed to learn more about strip mining.

Anyone researching strip mining will quickly become aware that the Senate and House of Representatives of the United States have already addressed the issue of the reclamation of prime farmland. The Surface Mining Control and Reclamation Act of 1977 assured us that our environment would be protected from the adverse impacts of surface mining. PL 95-87 states that the Congress found the technology of reclamation at a point where it is appropriate to place regulations on the industry, "to minimize so far as practicable the adverse social, economic and environmental effects of such mining operations." (See Sec. 101, the Act).

The Act gave us encouragement when we read in its purposes, one of which was, "to establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations. (Sec. 102 a, the Act). But perhaps the most important part of PL 95-87 for the preservation of farmlands was Section 510 d. This section requires the regulatory authority to find,

> "in writing that the operator has the technological capability to restore such mined area, within a reasonable time, to equivalent or higher levels of yield as non-mined prime farmland in the surrounding area under equivalent levels of management and can meet the soil reconstruction standards in Se. 515 b." (Sec. 510 d).

The members of the IW3C believed that PL 95-87 provided the basis for adequate regulation of the surface mining industry. The strong support provided by Senator Charles Percy (R - Illinois) and other senators and congressmen for the Act assured us of its continued implementation. Although it was also necessary to have regulating agencies enforce the Act, we had thought that the Federal Office of Surface Mining, (OSM) and the Illinois Department of Mines and Minerals, (IDMM) would fulfill their obligations.

We now fear that our faith and trust have been misplaced. It appears to us that the agencies charged with enforcing PL 95-87 have decided to ignore the intent of the Act through lax enforcement and/or weakened regulations.

Our research leads us to conclude that the Secretary of the US Department of the Interior James Watt has decided to reduce the strength of PL 95-87 by limiting the ability of OSM to monitor the strip mining industry and by changing regulations to the Act. We also conclude that IDMM has not adequately evaluated Surface Mining Permit #902 permitting Freeman United Coal Company's new mining operation on prime farmlands in McDonough County, thus revealing IDMM's basic approach to the task of regulating the mining industry as "defender of the industry." These conclusions are based in part on the following issues:

PRIME FARMLAND GRANDFATHER RULE:

The grandfather exemption clause [illegible] PL 95-87 provides an exemption from prime farmland demonstration and restoration requirements for mines with an approved mining plan or permit prior to August 3, 1977, or contigious expansions of active mining operations. (CFR 716.7 (a)(2)(i)(ii). Our understanding of this action is that Congress wanted to give coal operators a grace period to get equipment ordered and on-site as well as time to make new reclamation plans in order to meet the new requirements. A cut-off date of August 3, 1982, was proposed to end the grandfather exemption. This date was to be made effective January 23, 1981. However, it was postponed. It was postponed on Feb. 7, 1981, March 23, 1981, April 3, 1981, April 29, 1981, June 15, 1981 and August 17, 1981. Now the cut-off date has been eliminated entirely by Mr. Watt.

This action is being taken ofter OSM solicited and received voluminous comments from the public on whether the rules should become effective, modified or suspended indefinitely. (See Attachment #5). Now OSM has already received "voluminous" comments and when comments were received concerning the January 23, 1981, rule, most were copies of earlier comments! It appears to us that the public is not asking for time to make further comments. The comments have already been made. It is time for Sec. Watt to make a decision.

The people that I represent believe that the elimination of the cut-off date is an attempt to circumvent the requirement to reclaim land to 100% productivity. Secretary Watt is using his authority to weaken the Act.

We are calling for a decision to end all grandfathering as of August 3, 1982.

REORGANIZATION of OSM:

The citizens in McDonough and other Midwestern counties are very concerned about the reorganization plan presented by OSM Director J. Richard Harris. Very few people in McDonough County (including farmers) can be considered expert soil scientists or agronomists. We rely on the help and advice offered by professionals in these important areas. The reorganization of OSM will remove these technical experts from Illinois. The OSM will not have a soil scientist stationed in Springfield. The Illinois Department of Agriculture does not employ a soil scientist in its Land Reclamation and Watershed Treatment Section. The Soil Conservation Service does not have a soil scientist employed in the area which includes McDonough County. Where are we to find information and assistance? Our only recourse will be to seek help from IDMM - the very agency we mav be seeking to challenge.

Director Harris has assured us that the technical experts stationed in Wyoming and Pennsylvania will be available to us through telephonic and written communications as well as travel to the subject mine sites when the situations warrent. Being somewhat of an expert on human nature, I find this to be a rather naive expectation. Telephone calls are expensive for citizens in Illinois to make to Pennsylvania. Written communications will be ineffective when citizens do not know technical language and symptoms of problems. Perhaps more important, what will be the criterion to determine whether a visit is warrented?

The reorganization of OSM will effectively remove technical assistance from the citizens it is charged to serve. This action will cripple any effort by citizens to become involved in the oversight of mining operations in their communities. We ask that OSM continue to staff its office in Springfield with technical experts.

APPROVAL of STATE PROGRAMS:

PL 95-87 provides for each state to assume jurisdiction over the regulation of surface coal mining and reclamation when the state demonstrates it has the capability of carrying out the provisions of the Act (Sec. 503 a). Illinois must submit a permanent program to be considered for primacy.

Illinois has submitted a plan for the Secretary's approval which does not track the regulations designed to implement the Act. We are concerned that the Illinois Permanent Program may be accepted and provide the state with primacy even though it does not adequately reflect the intent of Congress expressed in PL 95-87. These concerns are based on the apparent change of philosophy of the new administration which is being revealed in the desire to develop an economic climate favorable to industry. The IW3C believes it is the Secretary's desire to approve the State Program even though it may differ in significant ways from the Federal Program as it now appears.

Approving a state program after making significant changes in regulations to fit that state program is confusing to the public and makes it very difficult for citizens to participate in the decision making process.

It is our opinion that the Secretary is attempting to use policy decisions to make radical changes in the intent of the Act and thus eliminate the ability of citizens to be heard. The Illinois State Program should be approved only if it meets the criteria of Sec. 503, not because the Secretary wishes to hurry the decision.

CHANGES in BONDING REGULATIONS:

Several changes in the regulations about performance bonding are now being considered by OSM (46 FR 45082). The citizens I represent believe that these changes greatly weaken the ability of performance bonds to insure proper reclamation of prime farmland. Included in the proposed regulations are changes that would allow a coal company to bond itself with no security other than a promise and a release of bond based on yield production with no clause for "equivalent management practices." We agree with Mr. George Tinkham, Chief of the Land Reclamation Bureau, IL Department of Agriculture, that there are some major problems with these changes in the bonding regulations (See Attachment #6). Once again it seems the Secretary ~~is~~ seeking to weaken the enforcement of the Act.

ISSUES RELEVANT to FREEMAN COAL CO. PERMIT in McDONOUGH COUNTY:

The issues presented to this point have been based on the research we developed from the study of PL 95-87. The IW3C also examined the Permit and the "Synopsis on Conclusions on Relclamation Plan and Public Hearing Comment" (SCRPPH) provided by IDMM for the Freeman United Coal Company's new mine in McDonough County. Once again we found the documents to be very impressive when first considered, but on closer scrutiny several questions were raised. The questions are serious enough to suggest that IDMM did not adequately represent the public interest in the issuance of the permit. The questions include the number of soil samples taken to determine the acceptability of mixing the B and C soil horizons, the evidence used to determine the ability of Freeman United Coal Company to reclaim the land to 100% of pre-mined productivity and the role of IDMM in co-ordinating the information received from other agencies.

The OSM soil scientists based in Illinois, Mr. Keith Sheckler and Mr. Jack Simpson, questioned the number of soil samples taken to study 1,178 acres of prime farmland restoration. Freeman Coal Company submitted results from four core samples, three of which covered the total depth of unconsolidated material and the fourth only thirteen feet, to determine that the B and C horizons could be mixed and provide a reconstructed soil which would be of equal or better value for crop production when compared to previous soil conditions.

Mr. Sheckler and Mr. Simpson determined that enough variation existed in the samples that it warrented additional sampling. A reasonable procedure suggested by Mr. Sheckler was to use the "random sample procedure" utilized by IDMM to check post-mining soil replacement. This would have resulted in twenty to twenty-four samples being used to determine the soil qualities. The IDMM responded, "The parent material of the soil is substantially similar throughout the proposed permit area. Therefore, four core samples were deemed sufficient." (SCRPPH, page 2 - 1. Appendix 2). We believe that four core samples, one incomplete, are not enough to determine the soil quality of 1,178 acres of prime farmland. It was not unreasonable to request more core samples as MR. Sheckler and Mr. Simpson did at the time. This issue is an example of IDMM's attempt to keep the permit process "easy going" for the coal industry even at the cost of accurate information and the public interest.

A second major question is raised when one studies the data provided by Freeman United to determine their ability to return the land to 100% pre-mined productivity. Serious questions were raised about this data and its application to the mine site in McDonough County (See Attachments 7 and 8), yet the objections were never seriously addressed by IDMM. Perhaps most revealing is the statement by Taylor Pensoneau, Vice President of the IL Coal Association, that restoring farmland to a condition equal to or better than it was before mining, as the Act requires, "technologically, is almost impossible". (Attachment #9). Perhaps less dramatic, yet quite accurate, is the position taken by Dr. Ivan Jansen, University of Illinois Agronomist, that reclamation of strip mined topsoil is a long and expensive process, the final results of which are not yet known (Attachment #10). The IW3C is concerned that the IDMM did not take its responsibility to the citizens of McDonough County seriously when it accepted the data presented by Freeman United Coal Company. The concerns expressed in the permit process were acknowledged but not considered; heard but not answered.

Even more troubling than the above mentioned issues is how IDMM acted to co-ordinate the information flowing from the other agencies which considered the permit. The manner in which, for example, the information surrounding the mixing of the b and c soil horizons indicates that IDMM was more concerned with the expeditious approval of the permit to Freeman than a careful study of the impacts. Mr. William J. Hartman, USDA Area Conservationist, stated:

"If Freeman's B and C horizon mix was ment to include all unconsolidated geologic deposits below the B horizon, we feel that the mixture would result in a reconstructed soil which will not have equal or greater productive potential as the original prime farmland soils." See Attachment #11).

Unfortunately this statement was made after the IDMM had approved the strip mining permit.

The members of the IW3C believe that IDMM should be more active in informing and co-ordinating other agencies involved in the permitting process. If the agencies involved are unaware of their responsibilities - how are citizens expected to be involved in the process?

CONCLUSION:

The citizens I represent want the prime farmland in Central Illinois to be protected and preserved from the onslaught of the coal companies. Congress has clearly indicated that our concerns are not just regional but nationwide. These concerns were addressed in PL 95-87, a landmark in the history of agriculture in America. We acknowledge our debt to those who worked to pass and implement this law. But now we fear that the Act is in the process of being stripped of its ability to protect our farmlands.

The Secretary of the Interior, the Director of the Office of Surface Mining and the Director of the Illinois Department of Mines and Minerals are not acting to balance concerns of agriculture and the coal companies - but are bending over backward to open the prime farmlands of Illinois to strip mining for coal.

We, citizens of Illinois, ask for this Subcommittee's assistance to help us protect our most valuable natural resource from destruction.

Thank you very much.

Rev. Kenneth E. Hogren, Co-Chair.
Illinois West Central Conservation Coalition
Box 234, Blandinsville, IL 61420
(309) 652-3735

Attachmts.
Included.

land & water October 1981

111

ATTACHMENT #1

PLAIN TALK

PAUL A. BUCHA
Executive Vice President
LAND IMPROVEMENT
CONTRACTORS
of AMERICA

LICA

AS AGRICULTURE GOES — SO DOES THE U.S. ECONOMY!

In the tug-of-war with interest rates our economy is slowly — but inexorably — being pulled off balance. A national survey of land improvement contractors conducted by LICA recently indicated that contractors attribute most of the blame for sluggish business in 1981 to the prevailing high interest rates. The recent drop in the stock market probably reflects a similar conviction among U.S. financial and business circles.

The agricultural segment of our economy is being hit from all sides in this tug-of-war and how agriculture fares may determine whether we will fall into a full-blown depression or luckily escape with a mild recession. Farmers traditionally are borrowers — and with interest rates around 20% farmers are less likely to buy new farm machinery, will cut back on borrowing for seed and fertilizer, and may be less likely to spend hard-to-get cash for conservation practices — whether or not any government cost shared money is available to them.

On top of all this the farmer is now being hit with the after effects of the Carter grain embargo against the Soviet Union. As we forecast at the time this embargo was first imposed — there was a great risk that once the embargo was lifted, the huge Soviet market would no longer be ours to play around with! Although the Soviet Union is faced with severe agricultural shortages in grains, they are negotiating huge contracts for grain purchases with Argentina, Australia, and Canada and keeping their dependence on the United States to an absolute minimum. Thus, as we lost our Japanese soybean market to Brazil under Nixon, we appear to have lost our Russian grain market to Argentina, Australia, and Canada under Carter! As a result, the combination of high interest rates and reduced markets combine to make the agricultural economic prospects quite bleak for the near future.

How does this outlook for agriculture affect our overall economic picture? What does this portend for the land improvement contractor whose business is so closely tied in with the state of American agriculture? Here are some little known facts that we should know:

1) **Agriculture is the nation's #1 industry.** Taken as a whole, agriculture's assets come to $927 billion. That figure dwarfs even the U.S. budget, which this year will run about $655 billion. (In Washington, DC we rarely think that **anything** is larger than our budget. It is refreshing to know that something is.)
2) **Agriculture is the nation's #1 employer.** The U.S. labor force is roughly 105,600,000 strong. Of that, 17,000,000 persons are employed in some phase of agriculture. This is several times the number of workers in the transportation, steel, and automobile industries combined.
3) **Agriculture is #1 in productivity growth.** Productivity on our farms grew more than four times faster than it did in non-farm industry since 1976. Twenty years ago one farm worker supplied enough food for 28 people. Now one worker provides enough for 68 people.
4) **Agriculture is our #1 exporter.** It is noteworthy that farm exports totaled $42 billion in 1980. That makes agriculture by far the leading positive factor in our balance of payments.

The list goes on. For instance: The average Asian farm worker produces 4,400 pounds of food crops per year, the average Soviet farm worker - 33,000 pounds, and the average European farm worker - 35,000 pounds while the average U.S. farm worker produces 375,000 pounds per year.

Is there any question why it is important for us to maintain our agriculture base? □

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ATTACHMENT #2

Where Have the Farm Lands Gone?

National Agricultural Lands Study

New Executive Office Building
722 Jackson Place, N.W.
Washington, D.C. 20006
(202) 395-5832

Robert Gray
Executive Director

Michael Brewer
Research Director

Shirley Foster Fields
Information Director

Participating Agencies

Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Housing and Urban Development
Department of the Interior
Department of State
Department of Transportation
Department of the Treasury
Environmental Protection Agency
Water Resources Council

"Where Have The Farm Lands Gone? *was produced, researched and written by Shirley Foster Fields and published by the National Agricultural Lands Study, New Executive Office Building, 722 Jackson Place, N.W., Washington, D.C. 20006. First printing September 1979; second printing January 1980; third printing May 1980. Photos courtesy USDA. Additional copies are available on request.*

This Land Is Your Land *words and music by Woody Guthrie.* TRO-©-1956, 1958, 1970 Ludlow Music, Inc., New York, N.Y. Used by permission.

> ***"Ten years from now, Americans could be as concerned over the loss of the nation's prime and important farm lands as they are today over shortages of oil and gasoline"***

ATTACHMENT #3

AGRICULTURAL AREAS ACT

Block Speaks On Farmland Protection

EDITOR'S NOTE. The following remarks were prepared for delivery by Sec. John R. Block, before the National Agricultural Lands Conference in Chicago on Tuesday, Feb. 10.

On Tuesday night, Dec. 30, 35 folks from my home county—Knox County here in Illinois—got together with two officials of the Illinois Department of Agriculture. The purpose of the session was to discuss the Agricultural Areas Act, a relatively new piece of state legislation and one of which I'm particularly proud.

Ron Darden and Chris Mosher explained the Act's purpose—to protect Illinois farmland from development and from state and local pressure to shift land to other uses. They talked about its practicality, the fact that it's a basic tool to be used with county zoning laws.

They emphasized the role of local government in protecting prime Illinois land and estimated the consequences of the continued annual loss of 100,000 acres of Illinois farmland to nonagricultural uses: fewer exports, higher food prices, and a reduced national balance of payments by the year 2,000.

Perhaps most important, Ron and Chris stated for the people of Knox County the significance of the Agricultural Areas Act: the fact that for the first time it makes official, lays out in legislated black and white, state recognition of the value of farmland for agricultural purposes.

I don't recount our state experience to boast. We did what had to be done. I believe that those of us in Illinois government had an obligation to ourselves and to the people of this country to protect our land. And I believe that responsibility was mandated long before we passed legislation in July 1, 1980, by certain facts and figures that are as much a part of this state as the city of Chicago.

I tell you about our state experience because the contradictions in Illinois agriculture are what the National Agricultural Lands Study is about.

Eighty percent of Illinois cropland is prime land. That's a rich blessing, but it's also a tremendous responsibility. With that bountiful land, the state provides more than one-tenth of the nation's food supply and over 17 percent of its exports. That means a continuing high level of dependence on Illinois by our own country which must look to agriculture to redeem an oil-heavy trade deficit and by other nations which face a growing gap between their ability to produce and their consumption demands.

Now weigh those obligations against the fact that Illinois each year is losing about 6.7 tons of soil per acre to erosion and the equivalent of 373 averaged-sized farms to farmland conversion. It becomes apparent that the increasing pressure on our best land and our decreasing ability to produce from prime land are pulling against each other.

We Americans are a funny people. We're people of surplus. We consider it our heritage and our right. Yet in taking bounty for granted in our own lifetime, we may deny our children. We see no limits, recognize no boundaries.

As I see it, everyone involved in the National Agricultural Lands Study, everyone who will influence agricultural land policy in the coming decade, has three difficult, immediate and top-priority responsibilities.

The first is to change the way Americans think about their land—to make them think about their land. R. Neil Sampson, of the National Association of Conservation Districts, calls for a new "land ethic."

All of the statistics, legislation and studies mean nothing without a basic understanding that in the next 20 years we cannot realize a 60-85 percent increase in demand for U.S. agricultural products while urbanizing 3 million acres of productive land each year and maintaining current low productivity rates.

The second responsibility is to make Americans understand that the situation is a crisis in the making. The present agricultural land situation has been compared to the energy conservation issue of 10 years ago. Since 1973, we've increase our dependence on foreign oil by nearly 50 percent.

Our foreign oil bill has increased thirty-fold in the last decade. But until gas lines wrapped three times around the block in the summer of 1979, the crisis wasn't immediate and Americans didn't take note.

The conversion of our agricultural lands is a potential crisis on several counts. To meet projected demands for the next 20-years, most of the nation's 540-million-acre cropland base would have to be in cultivation. This would mean major shifts in the U.S. agricultural system: taking land away from forage and grazing uses, farming poor-quality land that is costly to cultivate and subject to erosion and environmental problems, and resulting higher food prices. The chain of problems would be lengthy and expensive.

The third responsibility is to convince the nation that once we reach the crisis stage, there's no turning back. The effects of urbanization are irreversible. We won't be talking critical problems; we'll be talking fatalities.

The National Agricultural Lands Study has built a strong case for establishing a national policy for protecting good agricultural land. I support such a policy. I support wrapping up the studies now and taking action. And in this time of severe fiscal restraint, as discussed last Thursday night by President Reagan, I also support the study's recommendation that state and local governments take the lead and federal agencies lend support.

In discussing fiscal responsibility, the President talked about leaving our children liberty.

Liberty is really what we're talking about today. Liberty doesn't mean the freedom to squander resources and evade responsibility. It means taking on responsibility so that we have the freedom to make deliberate, conscious choices about our future.

3/21/81
Point of fact: This Bill was dead in Committee where it had languished 2 yrs.
In 1976 Chris + J. Johnson sat down & planned how to resurrect it. Chris got right on it. I helped somewhat. My ICW experience & SWCD Bd. to help. - It passed shortly after that.

MARCH 4, 1981 Section of Galva News and WRCVA Reporter

May 8, 1981

Honorable James G. Watt
Secretary of Interior
Washington, D. C. 20240

Dear Jim:

The Office of Surface Mining (OSM) has requested comments on the proposed suspension of final rules regarding exemptions and definitions for the prime farmland aspects of OSM's regulatory programs implementing the Surface Mining Control and Reclamation Act of 1977. This Department, through our RECLAM Coordination Committee, by letter of May 6, 1981, has provided formal comments suggesting that the rules not be suspended. Because of my personal concern about the need to protect fully our prime farmland resource while we are attempting to develop other resources, I want to add my personal thoughts to those expressed earlier by the Department.

Prime farmland is, of course, our best farmland, in that it produces high crop yields with the least unavoidable damage to the soil. As of 1977, three hundred and forty-six million acres of prime farmland remained in the United States. However, of the three million acres of rural land converted annually to non-agricultural uses, approximately one million are prime farmland. Of course, not all of this conversion was a result of surface mining, but it is estimated that approximately one hundred thousand to one hundred and sixty thousand acres of prime farmland is subjected to surface mining annually.

A purpose of the Act is to protect these lands by the imposition of appropriate surface mining restrictions and reclamation requirements which pertain particularly to prime farmlands. This Department has worked with OSM since 1977 to develop regulations to provide the protection envisioned by the Act. We have pursued this cooperative course, not only because of our duties under the Act, but because of our responsibility to provide leadership in the protection of prime farmlands.

We believe sound public policy dictates that prime farmlands be accorded the full protection envisioned by the Act. The initial and permanent regulations are, of course, critical for achieving that end. For this reason, we do not favor any suspension of the effectiveness of Section 716.7(a) and (b) governing the Interim Program nor of Section 785.17(a) which concerns the Permanent Program. We recognize that the rule-making process has been protracted by consultation and comment periods, litigation and other factors all of which have played a part in developing the regulations as they presently appear. We, also, understand OSM's concern for avoiding imposition of unnecessary revisions upon states in the implementation of their own regulatory programs and we do not want to pre-judge the proposed reevaluation process for the regulations. However, we are not convinced in this instance that no regulation at all is better than a regulation which is subject to revision. As we assess the situation, the interim program regulations were declared invalid by the Federal court and remanded to OSM for reconsideration. We find the statutory standards concerning the "grandfather clause" and "historical use" are sufficiently vague to require clarification through regulation if the purpose of the Act is to be uniformly upheld. We note that, contrary to the assertion of the deferral notice in the April 3, 1981, Federal Register, 46 FR 20211, there are no "prior versions of each rule to remain in effect until completion of new rulemaking proceedings" for the Interim Program.

As a consequence of litigation, a number of key midwestern states, including Illinois, Indiana and Ohio, cannot submit revised State Plans to your Department until specfic dates in the future. Such states also are not under the Permanent Program.

Therefore, I believe it is imperative that the protections provided by the regulations be made effective as soon as possible, regardless of the fact that they may later be reevaluated.

Sincerely,

SECRETARY

JOHN R. BLOCK
Secretary

SEC:CMosher:OGC:SShelton:rn:5/8/81:x72798

cc: OGC
SCS
JCrowell

ATTACHMENT #4

CHAPTER 5

AGRICULTURE AND HORTICULTURE

AGRICULTURAL AREAS CONSERVATION AND PROTECTION ACT

P.A. 81-1173, effective July 1, 1980

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AGRICULTURAL AREAS CONSERVATION AND PROTECTION ACT

AN ACT to provide for the establishment of agricultural conservation and protection areas and to amend an Act named in connection therewith. P.A. 81-1173, certified Nov. 29, 1979, eff. July 1, 1980.

1001. Short title

§ 1. Short title. This Act shall be known and may be cited as the "Agricultural Areas Conservation and Protection Act".

1002. Legislative findings and intent

§ 2. Legislative findings and intent. It is the policy of the State to conserve, protect and to encourage the development and improvement of its agricultural lands for the production of food and other agricultural products. It is also the policy of this State to conserve and protect agricultural lands as valued natural and ecological resources which provide needed open spaces for clean air sheds as well as for aesthetic purposes. Agriculture in many parts of the State is under urban pressure from expanding metropolitan areas. This urban pressure takes the form of scattered development in wide belts around urban areas, brings conflicting land uses into juxtaposition, creates high costs for public services, and stimulates land speculation. When this scattered development extends into productive farm areas, ordinances inhibiting farming tend to follow, farm taxes rise, and hopes for speculative gains discourage investments in farm improvements. Much agricultural land in Illinois is in jeopardy of being lost for any agricultural purpose. Certain of these lands constitute unique and irreplaceable land resources of Statewide importance. It is the purpose of this Act to provide a means by which agricultural land may be protected and enhanced as a viable segment of the State's economy and as an economic and environmental resource of major importance.

1003. Definitions

§ 3. Definitions. As used in this Act, unless the context otherwise requires, the terms specified in Sections 3.01 through 3.08 [1] have the meanings ascribed to them in those Sections.

1003.01. Agricultural production

§ 3:01. "Agricultural Production" means the production for commercial purposes of crops, livestock and livestock products, but not land or portions thereof used for processing of such crops, livestock or livestock products.

1003.02. Crops, livestock and livestock products

§ 3.02. "Crops, livestock and livestock products" include but are not limited to the following: legume, hay, grain, fruit, and truck or vegetable crops, floriculture, horticulture, mushroom growing, nurseries, orchards, forestry and greenhouses; the keeping, raising and feeding of livestock or poultry, including dairying, poultry, swine, sheep, beef cattle, pony and horse production, fur, fish and wildlife farms, farm buildings used for growing, harvesting and preparing crop products for market, or for use on the farm; roadside stands, farm buildings for storing and protecting farm machinery and equipment from the elements, for housing livestock or poultry and for preparing livestock or poultry products for market; farm dwellings occupied by farm owners, operators, tenants or seasonal or year-round hired workers.

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[1] Paragraphs 1003.01 to 1003.08 of this chapter.

1003.03. Public agency

§ 3.03. "Public Agency" means the State of Illinois or any political subdivision, or any agency, board, or department thereof, any special district, any municipality or any unit of local government.

1003.04. Viable farm land

§ 3.04. "Viable Farm Land" means land suitable for agricultural production and which will continue to be economically feasible for such use if real estate taxes, farm use restrictions, and speculative activities are limited to levels approximating those in commercial agricultural areas not influenced by the proximity of urban and related non-agricultural development.

1003.05. County committee

§ 3.05. "County Committee" means the County Agricultural Areas Committee.

1003.06. Active farmer

§ 3.06. "Active Farmer" means any individual actively involved in the day-to-day operation or management of a farm and deriving at least 50% of his gross income from such management or operation.

1003.07. County board

§ 3.07. "County Board" means the county board of any county in this State except those counties with a population of 1 million or more.

1003.08. County appointing authority

§ 3.08. "County Appointing Authority" means a group comprised of the county board chairman, the county agricultural extension advisor and the chairman of the county soil and water conservation district which appoints persons to serve on the county agricultural areas committee.

1004. Agricultural areas committee

§ 4. Agricultural Areas Committee. A county board may establish a county committee which shall consist of four active farmers, no more than two of whom shall be of the same major political party, and a member of the county board. The committee shall select one of its members to serve as chairman of the county committee. Such a committee shall be established whenever a petition is received by the county board for the creation of an agricultural area pursuant to Section 6,[1] provided that no such county committee has already been established for such county. Members of such county committee shall be appointed by and shall serve at the pleasure of the county appointing authority. The members shall serve without salary, but the county board may entitle each such member to reimbursement for his actual necessary expenses incurred in the performance of his official duties. Such committee shall advise the county board in relation to the proposed establishment, modification, and termination of agricultural areas. The county committee shall render expert advice relating to the desirability of such action, including advice as to the nature of farming and farm resources within the proposed area and the relation of farming in such area to the county as a whole.

1005. Agricultural areas—Creation

§ 5. Agricultural Areas; Creation. Any owner or owners of land may submit a proposal to the county board for the creation of an agricultural area within such county. An agricultural area, at the creation of any such area, shall not be less than 500 acres. Such proposal shall include a description of the proposed area, including the boundaries thereof. Such territory shall be as compact and nearly contiguous as feasible. An area created under this Act shall be established for a period of ten years. No land shall be included in an agricultural area without the consent of the owner.

1006. Duties of county board

§ 6. Duties of the County Board. (a) Upon the receipt of such a proposal, the county board shall provide notice of such proposal by publishing a notice in a newspaper having general circulation within the proposed area or, if no such newspaper has a general circulation within the proposed area then in a newspaper having general circulation within the county and by posting such notice in five conspicuous places within the proposed area. A copy of such notice shall be sent to the county or regional planning commission for review or comment within 30 days. Such comment shall be made to the county board. The notice required to be published or posted under this Section shall contain the following information.

1. a statement that a proposal for an agricultural area has been filed with the county board pursuant to this Act;

2. a statement that the proposal will be on file open to public inspection at the county clerk's office;

3. a statement that any landowner, owning land adjacent to or partially encompassed by the proposed area may propose a modification of the area to include or exclude such lands, within 30 days of the date of publication of notice. Such application shall be made on forms prescribed by the county board;

4. a statement that any proposed modification must be filed with the county clerk and the clerk of the county board within 30 days after the publication of such notice;

5. a statement that at the termination of the 30 day period, the proposal and proposed modifications will be submitted to the county committee, and that a public hearing will be held on the proposal, proposed modifications and recommendations of the county committee.

(b) The county board shall receive any proposals for modifications of such proposal which may be submitted by the landowners within 30 days after the publication of such notice.

(c) The county board shall simultaneously, upon the termination of such 30 day period, refer such proposal and proposed modifications to the county committee, which shall, within 45 days report to the county board its recommendations concerning the proposal and proposed modifications.

1007. Public hearing required

§ 7. Public Hearing Required. The Agricultural Areas Committee of the county board shall hold a public hearing on any proposal for the creation of an agricultural area. Such hearing shall be held at a place within the proposed area or a place readily accessible to the proposed area. Notice of the hearing shall contain a statement of the time, date and place of the public hearing and a description of the proposed area and any proposed additions. Such notice shall in addition contain a statement that the public hearing will be held concerning the original proposal, any written amendments proposed during the 30 day review period and any recommendations proposed by the county committee or the planning commissions. The notice shall be published in a newspaper having a general circulation within the proposed area or if no newspaper has general circulation within the proposed area, then in a newspaper having general circulation within the county, and shall be given in writing to the persons owning land within such a proposed area.

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[1] Paragraph 1006 of this chapter.

1008. Factors for consideration in formation of agricultural areas

§ 8. Factors for Consideration in Formation of Agricultural Areas. (a) The following factors should be considered by county boards, county committees, or planning commissions, with respect to the formation of any agricultural area:

1. the viability of active farming within the proposed area and in areas adjacent thereto;

2. the presence of any viable farmlands within the proposed area and adjacent thereto that are not now in active farming;

3. the nature and extent of land uses other than active farming within the proposed area and adjacent thereto;

4. county developmental patterns and needs; and

5. any other matter which may be relevant.

(b) In judging viability, any relevant agricultural information shall be considered, including soil, climate, topography, other natural factors, markets for farm products, the extent and nature of farm improvements, the present status of farming, anticipated trends in agricultural economic conditions and technology, and such other factors as may be relevant.

1009. Notice to, and objections by, municipal authorities

§ 9. If the proposed agricultural area includes real estate within a 1½ mile radius from the corporate limits of any municipality, the county board shall notify the municipal authorities of such affected municipality of this proposed area. Such municipal authorities may object to the proposal if such objection is presented to the county board within 30 days of the receipt of the proposal by the municipal authorities. Upon receipt of such objection by the county board, the proposed area shall be modified to exclude the real estate within the 1½ mile radius of the corporate limits of such municipality. If no objection is received within the specified time period, the affected real estate shall be included in the agricultural area.

1010. Adoption of plan by county board

§ 10. Adoption of Plan by County Board. The county board, after receiving the reports of the county committee and other comments, and after such public hearing, may adopt as a plan the proposal or any modification of the proposal it deems appropriate, including the inclusion, to the extent feasible, of adjacent viable farmlands, and the exclusion, to the extent feasible, of non-viable farmland and non-farm land. The county board shall act to adopt or reject the proposal, or any modification of it not later than 45 days from the date the proposal was submitted to it.

1011. Requirement that description of agricultural areas be filed with county clerk and county recorder

§ 11. Requirement that Description of Agricultural Areas be filed with County Clerk and County Recorder. Upon the creation of an agricultural area, the description thereof shall be filed by the county board with the county clerk. Such description shall also be placed on record in the office of the county recorder of deeds.

1012. Petition for withdrawal

§ 12. Petition for Withdrawal. Any person may submit a petition to the county board requesting the withdrawal of land from the agricultural area located within that county. Such petition must contain:

1. A statement indicating the proposed alternative use of the land.

2. An explanation of the necessity for changing the current use.

3. An explanation why land outside the agricultural area would not be suitable for proposed use.

1013. Procedures for consideration of petition for withdrawal

§ 13. Procedures for Consideration of Petition for Withdrawal. 1. Within 5 days after the receipt of a petition for withdrawal of land from an agricultural area, the county board shall provide notice of such petition by publishing a notice in a newspaper having general circulation in the immediate area of the affected land or, if no such newspaper has a general circulation within such area, then in a newspaper having general circulation within the county, and by posting such notice in 5 conspicuous places within the immediate area of the affected land. Such notice shall contain the following information:

(a) a statement that a petition for withdrawal of land from an agricultural area has been filed with the county board pursuant to this Act;

(b) a statement that the petition will be on file open to public inspection at the county clerk's office;

(c) a brief, narrative description of the location of the affected land;

(d) a statement of the proposed non-agricultural use of the land;

(e) a statement that the petition will be referred to the county committee and to the regional and county planning commissions, if any, for review and comment;

(f) a statement that a public hearing will be held within 60 days on the petition and on the recommendations of the county committee and of the regional and county planning commissions, if any, at a time and place to be announced.

2. Within 5 days after the receipt of a petition for withdrawal of land from an agricultural area, the county board shall refer the petition to the county committee, which shall, within 30 days of its receipt of the petition, report to the county board its recommendations.

3. Within 5 days after the receipt of a petition for withdrawal of land from an agricultural area, the county board shall refer the petition to the regional and county planning commissions, if any, which shall, within 30 days of their receipt of the petition, report to the county board their recommendations concerning the potential effect of the withdrawal of land from an agricultural area upon the development patterns and needs of the county and upon the county's planning objectives.

1014. Procedures for public hearings on petitions for withdrawal

§ 14. Procedures for Public Hearings on Petitions for Withdrawal. The Agricultural Areas Committee of the county board shall hold a public hearing within 60 days of the receipt of a petition for withdrawal of land from an agricultural area. The hearing shall be held at a location readily accessible to the public and proximate to the affected land. Not less than 7 days prior to the date of the public hearing, the county board shall provide notice of such public hearing by publishing a notice in a newspaper having general circulation in the immediate area of the affected land, or, if no newspaper has a general circulation in the immediate area of the affected land, then in a newspaper having general circulation within the county. Such notice shall be given in writing to the owner or owners of land in or immediately adjacent to the agricultural area. Such notice shall contain the following information:

1. a statement of the date, time and place of the public hearing;

2. a description of the location of the affected land and the proposed non-agricultural use;

3. a statement that the public hearing will concern the petition and the recommendations of the county committee and of the regional and county planning commissions, if any.

1015. Withdrawal of land from an agricultural area

§ 15. Withdrawal of Land from an Agricultural Area. 1. Within 90 days after the receipt of a petition for withdrawal of land from an agricultural area, the county board shall accept or reject the petition in a written decision. The county board's decision shall take into account the review and comment of the county committee, the regional and county planning commissions, if any, and the public hearings held concerning the petition.

2. The county board must consider the factors included in Section 8 of this Act in making its decision. Analysis of such factors must be included in the county board's decision.

3. Any person adversely affected by a decision of the county board on a petition of withdrawal of land from an agricultural area may obtain judicial review by filing a petition for review within 35 days after the decision, pursuant to the provisions of the Administrative Review Act, as amended,[1] and the rules adopted pursuant thereto.

[1] Chapter 110, ¶ 264 et seq.

1016. Review of agricultural areas by county board

§ 16. Review of Agricultural Areas by County Board. The county board shall review any agricultural area created under this Act 10 years after the date of its creation and every 8 years thereafter. In conducting such review, the county board shall ask for the recommendations of the county committee, and shall, at least 120 days prior to such date, require the Agricultural Areas Committee to hold a public hearing at a place within the area or other readily accessible place upon notice being given in a newspaper having general circulation within the area or if there is no such newspaper, then in a newspaper having general circulation within the county, and individual notice in writing to the persons owning land within the area, and to the county or regional planning commission. The county board after receiving the reports of the county committee and after the public hearing, may terminate the area at the end of such 10 or 8 year periods by filing a notice of termination with the county clerk or the county board may modify the area in the same manner as is provided in Section 6 of this Act.[1] If the county board does not act, the area shall continue as originally constituted.

[1] Paragraph 1006 of this chapter.

1017. Petition for dissolution

§ 17. Petition for Dissolution. Ten years after the date of creation of any agricultural area, owners of land within such area may petition the county board to dissolve the area. Such petition must be submitted in writing to the county board during the 120 day period immediately prior to the 10th anniversary of the creation of the area. Should the petition contain signatures of at least two-thirds of the landowners, their heirs, assigns or representatives, owning land within the area, the area shall be dissolved.

1018. Limitation on local regulations

§ 18. Limitation on Local Regulations. No local government shall exercise any of its powers to enact local laws or ordinances within an agricultural area in a manner which would unreasonably restrict or regulate farm structures or farming practices in contravention of the purposes of this Act unless such restrictions or regulations bear a direct relationship to the public health or safety.

1019. Policy of state agencies

§ 19. Policy of State Agencies. It shall be the policy of all state agencies to encourage the maintenance of viable farming in agricultural areas and their administrative regulations and procedures shall be modified to this end insofar as are consistent with the promotion of public health and safety and with the provisions of any federal statutes, standards, criteria, rules, regulations, or policies, and any other requirement of federal agencies, including provisions applicable only to obtaining federal grants, loans, or other funding.

1020. Limitation on power of certain public agencies to impose benefit assessments or special ad valorem levies

§ 20. Limitation on power of certain public agencies to impose benefit assessments or special ad valorem levies. No political subdivision providing public services such as sewer, water or lights or for non-farm drainage may impose benefit assessments or special ad valorem levies on land used for primarily agricultural production within an agricultural area on the basis of frontage, acreage, or value, unless such benefit assessments or special ad valorem levies were imposed prior to the formation of the agricultural area, or unless such service is provided to the landowner on the same basis as others having the service.

Agent Of The Month

FEBRUARY 1981

Kent Wildrick was named Country Companies agent of the month by Jerry Anderson, Agency Manager. Kent has been with the company since July 1979 and receives this recognition based on sales and service to his clients. Kent resides at R.R. #4 Macomb. Congratulations on a fine job, Kent.

McDonough County
FARM BUREAU NEWS
USPS 335-860
Phone 833-2174

Published monthly by McDonough County Farm Bureau, 210 South Randolph Street, Macomb, Illinois 61455 (incorporated). Entered as a second class matter postage paid at Macomb, IL. POSTMASTER: Send address changes to McDonough County Farm Bureau News, P.O. Box 249, Macomb, IL 61455.

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Prepared By The Farm Managers Of IAA Trust Company A Farm Bureau Company

If you have any question about farm management, send them to Dale Stinton, IAA Trust Company, P.O. Box 2901, Bloomington, Illinois 61701.

DO OIL AND GRAIN MIX?

QUESTION: **An oil company wants to drill for oil on my farm in southeastern Illinois. But my farm operator says the crop damage caused by their work and the problem of farming around an oil well – if and when they install it – will cause more trouble than its worth. What do you think?**

ANSWER: Your farm operator must have seen or heard about some of the problems caused by trying to harvest grain and oil from the same land.

The lure of "black gold" is so strong these days that many land owners don't think carefully about the damage that can be done to a farm operation while searching for oil. And they don't protect themselves with a good contract with the exploring company.

Problems won't crop up on every drill site. But I have seen rain-softened ground torn up by a large oil rig moving through a field. It left ruts visible for three years. And I've seen problems caused by the huge amounts of mud pumped out of an exploratory hole and simply left to slide down a hill.

In many cases, the crop damage payments provided by a contract with the oil company simply don't cover all the costs incurred by the farm owner. This usually happens when the agreement is not specific enough in its definition of "crop damage."

Look at any contract carefully. According to the contact, who will determine how much of the crop is lost? Will you be reimbursed for production expenses on the lost portion of the crop or for gross yield reduction? Is a reduction in yield two and three years after drilling covered by the contract?

I guess I may sound overzealous about this subject sometimes. But I strongly feel that time and effort spent now in defining and specifying payment for crop damage will save time, headaches and money later on.

Ask for help from an experienced attorney. Also, turn to your local Farm Bureau office and extension service office and general information about this subject.

WILL AG AREA AFFECT MY FARM?

QUESTION: **Several farmers in the area where I own land are forming an "agricultural area." As I understand it, this will limit use of the land to farming. Will this have any affect on my freedom to do what I choose with my farm?**

ANSWER: Probably not.

"Agricultural areas" are recent creations of Illinois law. The Agricultural Areas Conservation and Protection Act – which took affect July 1 1980 – provides a way for farm owners to join together to form ag areas protected by law.

In this case, protection includes limiting future use of productive farm land to the job it does best – growing food for the world.

The law establishes a state policy of "encouraging the maintenance of viable farming in agricultural areas."

Ag areas will have the largest impact in Illinois counties which do not now have zoning laws to protect farm land. Farm owners interested in this type of protection will petition county boards. As a result, county government will recognize these protected areas much as they would if tougher rural zoning laws had been enacted.

From your point of view, I don't think you should fear loosing your freedom to do as you please with your farm. First of all, even if all your neighbors join the ag area, there is no requirement for you to add your farm to the protected region.

In addition, the law doesn't prohibit non-farm development that you might undertake yourself. Ag areas seek to limit taking of the land for parks, highways and other non-farm uses. But they don't limit the options of the farm owner.

So, even if you join your local ag area, you will be free – within the limitations of local zoning laws – to do as you wish with your land.

* * *

It's not easy to get a high school education these days. You have to go to college to get it.

* * *

ATTACHMENT #5

DEPARTMENT OF THE INTERIOR

Office of Surface Mining Reclamation and Enforcement

30 CFR Parts 716 and 785

Surface Coal Mining and Reclamation Operations; Permanent Regulatory Program; Prime Farmland Grandfather Rules

AGENCY: Office of Surface Mining Reclamation and Enforcement, Interior.

ACTION: Amendments to final rule.

SUMMARY: OSM is revising the Prime Farmland Grandfather Rules as published on January 23, 1981, 46 FR 7894, the effective dates of which were postponed in **Federal Register** notices of February 4, 1981 (46 FR 10707), March 23, 1981 (46 FR 18023), April 3, 1981 (46 FR 20211), April 29, 1981 (46 FR 23924), June 15, 1981 (46 FR 31258), and August 14, 1981 (46 FR 41046), and the revisions include removing the cut-off date of the exemption. This action is being taken after OSM solicited and received voluminous comments from the public on whether the rules should become effective, modified, or suspended indefinitely. Accordingly, the rules which take effect today exempt certain permits and revisions or renewals of those permits from both the special prime farmland permits application and performance standards of the Surface Mining Control and Reclamation Act.

EFFECTIVE DATES: The amendments to §§ 716.7 and 785.17 are effective on September 29, 1981.

FOR FURTHER INFORMATION CONTACT: LeRoy deMoulin, Soil Scientist, Office of Surface Mining, Department of the Interior, 1951 Constitution Avenue, N.W., Washington, D.C. 20240, Phone (202) 343–5954.

SUPPLEMENTARY INFORMATION:

Background

The statutory basis, legislative history and rulemaking history of the prime farmland grandfather rules appeared in the Notice of Proposed Rules (45 FR 25992–95, April 16, 1980) and Notice of Final Rules (46 FR 7894–7900, January 23, 1981). That material will not be repeated here, but is incorporated and made a part hereof unless otherwise stated in this notice.

Related Litigation

Several parties filed lawsuits after publication of the rules on January 23, 1981. These cases are in the early stages of litigation and are entitled: *National Coal Association and American Mining Congess* v. *Watt, et al.*, Civ. No. 81-0193 (D.D.C.); *Peabody Coal Company* v. *Watt, et al.*, Civ. No. 81-0645 (D.D.C.); *Illinois Department of Mines and Minerals* v. *U.S. Department of the Interior, et al.*, Civ. No. 81-0708 (D.D.C.).

Analysis of Comments

The final regulations published on January 23, 1981, exempted all lands included in pre-August 3, 1977, permits and all revisions or renewals of those permits. Continuations of pre-existing surface coal mining operations would be exempt where the lands are: (1) an extension of a continuous mining pit or pits; (2) part of a single permitted operation; and (3) part of a continuous recoverable coal seam. The regulations also required that the permittee demonstrate that he or she had a pre-August 3, 1977, legal right to mine the exempted lands, and established a cut-off date of August 3, 1982. Numerous public comments were received on the issues of whether to modify, issue or suspend the rules indefinitely pending the outcome of further rulemaking. These comments are summarized and responded to in the following paragraphs.

General Comments

Several commenters expressed strong objection to the January 23, 1981, grandfather rule, stating that the rule will interfere with primacy and that the objectives of the Surface Mining Act will be better served by an indefinite postponement or extension of the January 23, 1981 rule followed by full notice and comment in a new rulemaking. Most of these commenters attached copies of their comments submitted at earlier stages of OSM's permanent program rulemaking on prime farmland and requested that those comments be reconsidered by OSM. Some commenters stated their belief that OSM had not seriously considered the prior comments in developing the grandfather rules. Other commenters merely expressed strong objection without specifying any details.

Several commenters also expressed strong objection to further postponement of the rule stating that there are no compelling reasons for delaying the protection afforded prime farmland under the January 23, 1981 regulations. These commenters stated that the productivity of thousands of acres of prime farmland will be in jeopardy because no prior rules remain in effect; that allowing the January 23, 1981 regulation to take effect would not interfere with primacy; and that regulations on this subject are needed because Section 510 of the Surface Mining Act is sufficiently vague to require clarification. Some commenters stated that they believed that OSM's justification for requesting notice and comment amounted to a prejudgment because the agency had already decided to suspend the January 23, 1981 rule and have a new rulemaking on prime farmland grandfather issues. Among those commenters who opposed further delay in implementing the January 23, 1981 regulations were several Members of Congress and the Secretary of the Department of Agriculture.

OSM rejects the assertion that it has prejudged this issue by assuming that the January 23, 1981 regulations would be suspended after a perfunctory notice and comment period. This may have been the impression left by the March 23, 1981 **Federal Register**, "Notice of Suspension of Certain Rules in 30 CFR, Chapter VII." (46 FR 17191–92.) As noted in the later **Federal Register** notice, the March 23, 1981 notice was published in error and was cancelled and superseded by the April 3, 1981 notice, 46 FR 20211, April 3, 1981. OSM has carefully considered all public comments received, including those comments filed in previous rulemakings which were incorporated in the public's comments filed in this rulemaking. The comments received on the issues of "pre-existing permits," "renewals and revisions of pre-existing permits," "existing surface coal mining operations" and definitions of "continuous mining pit" and "continuous surface coal mining operation" are discussed in the January 23, 1981 **Federal Register** notice (46 FR 7898–99) and that discussion is adopted here and incorporated by and made a part hereof. As stated in the January 23, 1981 notice announcing the final rule, the Secretary interprets the June 30, 1980 decision of the Court of Appeals to authorize him to place a reasonable limit on the extent of grandfathering in order to carry out the "purposes and provisions" of the Surface Mining Act. See 46 FR 7895 (January 23, 1981) and *In Re: Surface Mining Regulation Litigation*, No. 78-2191, 78-2192, Slip Op. (D.C. Cir., June 30, 1980).

OSM is cognizant of the claims of the State of Illinois that the portions of the rules made effective today "fail[ed] to exempt or otherwise give account to the distinct differences between surface and underground coal mining, to the application of this rule to surface structures and facilities, and to the physical characteristics of certain continuous and ongoing surface coal mining operations in Illinois." *Illinois Department of Mines and Minerals* v. *United States Department of the Interior*, No. 81-0708, D.D.C. Petition for

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Judicial Review, p. 3, filed March 24, 1981. OSM has worked closely with the State of Illinois in developing these regulations (see discussion at 45 FR 25994–95, April 16, 1980). OSM will continue to work closely with Illinois and all states in the context of state programs submissions and amendments in accommodating the physical characteristics of mining in each state. However, OSM makes this rule effective today in the belief that it is necessary to establish a general regulatory structure which responds to Congressional concern that the grandfather clause give some flexibility to existing operations and which clarifies a section of the Surface Mining Act which is accompanied by conflicting legislative history.

Exemption Termination Date

OSM has also carefully considered all comments received on the August 3, 1982 exemption cut-off date. See 30 CFR 716.7(a)(2)(vi) and 785.17(a)(6) of the final regulations published on January 23, 1981. OSM promulgated regulations containing the 1982 exemption termination date based in part on the experience of the State of Illinois. See discussion in proposed rule (45 FR 25994–95, April 16, 1980) and final rule (46 FR 7895–96, January 23, 1981). Two comments were received from the State of Illinois (the Department of Mines and Minerals and the Department of Agriculture) supporting the use of the 1982 termination date. Other general comments in support of and in opposition to the 1982 date were also received. At this time, OSM believes that an orderly transition period between pre-Act and post-Act prime farmland standards may be necessary to reduce wide variations in application of the law and to provide certainty to the public, states and operators on the scope of Section 510(d) of the Act. The public comments received by OSM in past rulemakings and in this rulemaking demonstrate that considerable controversy surrounds the concept of uniform termination date. In order to provide maximum public participation and to enable OSM and commenters to gather additional information on potential solutions to this issue, OSM announces here its intention to engage in further rulemaking on this issue. Meanwhile, the 1982 termination date which appeared in the January 23, 1981 rules will not be made effective and will be deleted. Persons desiring to submit written comments for consideration in proposing a new rule on termination of grandfathering should send those comments to the individual listed under the heading "For Further Information Contact:" [illegible] is, of course, willing to work with individual States desiring to include a more stringent provision (i.e., a termination date) in their programs.

The Office does not agree that the action taken today will interfere with state primacy or destroy thousands of acres of prime farmland. As noted in the January 23, 1981, Federal Register notice (46 FR 7897), there is an orderly procedure and opportunity for states to amend their programs to take this rule into account. In addition, the interim program rule at 30 CFR 716.7(a)(2) will become effective today in States without primacy and in States with primacy for those operations not yet permitted under permanent programs. In addition, and as noted in some public comments, eligibility for grandfathering does not automatically result in inadequate reclamation of the land. Such operations remain subject to the regular non-prime farmland performance standards of the Surface Mining Act, including topsoil protection, revegetation, postmining land use and bonding.

Editorial Correction

The following line appearing in 30 CFR 716.7(a)(2)(ii) on January 23, 1981 was inadvertently omitted from 30 CFR 785.17(a)(2)—(decision by the regulatory authority to allow) *changes in method of mining operations within the original permit area, or the decision of the regulatory authority to allow* (incidental boundary changes * * *). This correction makes the interim and permanent program regulations identical and is not considered a substantive change.

Statements Under E.O. 12291 and NEPA

OSM has determined that making this rule effective is not a major rule under Executive Order 12291 and a regulatory impact analysis will not be prepared.

OSM has determined that making this rule effective is not a major federal action significantly affecting the quality of the human environment based upon a finding of no significant impact (FONSI). The FONSI and environmental assessment are available to the public at OSM's Administrative Record, 1951 Constitution Avenue, N.W., Room 151, South Interior Building, Washington, D.C. 20240. Accordingly, an environmental impact statement will not be prepared.

Regulatory Flexibility Act

Pub. L. 96–354 requires that the head of an agency must make a certification of effect on small entities and publish the certification and reasons therefor in the appropriate Federal Register document. Following is the required certification.

I certify that making this rule effective will not have a significant economic impact on a substantial number of small entities. Potentially there are two groups who may be affected by the revised rules. They are small scale coal operators and small scale farmers who mine coal and grow their crops on prime farmlands. The numbers of small operators in the states most affected by mining are as follows: Kentucky 700, Indiana 30, and Illinois 20. However, the percentage of these operators mining on prime farmlands with a pre-August 3, 1977 permit is not available. This number is assumed to be small since the total acreage of prime farmland affected annually is relatively small. These same assumptions also are true for the number of farmers. In 1977 the annual affected prime farmland acreage was 21,800.

In forming these conclusions, it should be remembered that not all prime farmland is in crops and that even with a grandfather exemption the land must be returned to a "* * * condition capable of supporting the uses it was capable of supporting prior to any mining * * *". Overall, no national effect on small entities is expected and any localized regional impact would be minimal. The possible adverse effects would include the cost to the coal companies of meeting more stringent reclamation standards on prime farmlands and of these costs being passed directly on the coal consumer.

Dated: September 22, 1981.

Daniel N. Miller, Jr.,

Assistant Secretary, Energy and Minerals.

Final Regulations

The following regulations in Chapter VII of Title 30 of the Code of Federal Regulations are amended as follows:

PART 716—SPECIAL PERFORMANCE STANDARDS

A. 30 CFR 716.7 (a)(2) and (a)(3) are added to read:

§ 716.7 Prime farmland.

(a) * * *

(2) Except as otherwise provided in this paragraph, the requirements of the section are applicable to any lands covered by a permit application filed on or after August 3, 1977. This section does not apply to:

(i) Lands on which surface coal mining and reclamation operations are conducted pursuant to any permit issued prior to August 3, 1977, or

(ii) Lands on which surface coal mining and reclamation operations are conducted pursuant to any renewal or revision of a permit issued prior to August 3, 1977, or

(iii) Lands included in any existing surface coal mining operations for which a permit was issued for all or any part thereof prior to August 3, 1977, provided that:

(A) Such lands are part of a single continuous surface coal mining operation begun under a permit issued before August 3, 1977, and

(B) The permittee had a legal right to mine the lands prior to August 3, 1977, through ownership, contract, or lease but not including an option to buy, lease, or contract, and

(C) The lands contain part of a continuous recoverable coal seam that was being mined in a single continuous mining pit (or multiple pits if the lands are proven to be part of a single continuous surface coal mining operation) begun under a permit issued prior to August 3, 1977.

(3) For purposes of this section:

(i) "renewal" of a permit shall mean a decision by the regulatory authority to extend the time by which the permittee may complete mining within the boundaries of the original permit, and "revision" of the permit shall mean a decision by the regulatory authority to allow changes in the method of mining operations within the original permit area, or the decision of the regulatory authority to allow incidental boundary changes to the original permit;

(ii) a pit shall be deemed to be a single continuous mining pit even if portions of the pit are crossed by a road, pipeline, railroad, or powerline or similar crossing;

(iii) a single continuous surface coal mining operation is presumed to consist only of a single continuous mining pit under a permit issued prior to August 3, 1977, but may include non-contiguous parcels if the operator can prove by clear and convincing evidence that, prior to August 3, 1977, the contiguous parcels were part of a single permitted operation. For the purposes of this paragraph, clear and convincing evidence includes, but is not limited to, contracts, leases, deeds or other properly executed legal documents (not including options) that specifically treat physically separate parcels as one surface coal mining operation.

* * * * *

PART 785—REQUIREMENTS FOR PERMITS FOR SPECIAL CATEGORIES OF MINING

8. 30 CFR 785.17(a) is revised to read:

§ 785.17 Prime farmland.

(a) This section applies to any person who conducts or intends to conduct surface coal mining and reclamation operations on prime farmlands historically used for cropland. This section does not apply to:

(1) Lands on which surface coal mining and reclamation operations are conducted pursuant to any permit issued prior to August 3, 1977; or

(2) Lands on which surface coal mining and reclamation operations are conducted pursuant to any renewal or revision of a permit issued prior to August 3, 1977; or

(3) Lands included in any existing surface coal mining operations for which a permit was issued for all or any part thereof prior to August 3, 1977, provided that:

(i) Such lands are part of a single continuous surface coal mining operation begun under a permit issued before August 3, 1977; and

(ii) The permittee had a legal right to mine the lands prior to August 3, 1977, through ownership, contract, or lease but not including an option to buy, lease, or contract; and

(iii) The lands contain part of a continuous recoverable coal seam that was being mined in a single continuous mining pit (or multiple pits if the lands are proven to be part of a single continuous surface coal mining operation) begun under a permit issued prior to August 3, 1977.

(4) For purposes of this section:

(i) "Renewal" of a permit shall mean a decision by the regulatory authority to extend the time by which the permittee may complete mining within the boundaries of the original permit, and "revision" of the permit shall mean a decision by the regulatory authority to allow changes in the method of mining operations within the original permit area, or the decision of the regulatory authority to allow incidental boundary changes to the original permit;

(ii) A pit shall be deemed to be a single continuous mining pit even if portions of the pit are crossed by a road, pipeline, railroad, or powerline or similar crossing;

(iii) A single continuous surface coal mining operation is presumed to consist only of a single continuous mining pit under a permit issued prior to August 3, 1977, but may include non-contiguous parcels if the operator can prove by clear and convincing evidence that, prior to August 3, 1977, the non-contiguous parcels were part of a single permitted operation. For the purposes of this paragraph, clear and convincing evidence includes, but is not limited to, contracts, leases, deeds or other properly executed legal documents (not including options) that specifically treat physically separate parcels as one surface coal mining operation.

(Secs. 201, 501, 527 and 529, Pub. L. 95–87 Stat. 445 (30 U.S.C. 1201))

[FR Doc. 81–[illegible] Filed 9–28–81; 8:45 am]

BILLING CODE 4310–05–M

ILLINOIS department of
AGRICULTURE
Division of Natural Resources

ATTACHMENT #6

Illinois State Fairgrounds, Springfield, Illinois 62706
Phone (217) 782-6297

8 October 1981

Office of Surface Mining
U.S. Department of Interior
Administrative Records (TSR-11)
Room 153, South Building
1951 Constitutional Avenue, N.W.
Washington, D.C. 20240

Re: Comment on proposed rules
revising performance bonding

Dear Sirs:

The Illinois Department of Agriculture hereby submits its comments on the proposed new regulations designated 30 CFR 800 - 809, pursuant to the Notice of Proposed Rules in the 9 September 1981 Federal Register (46 FR 45082).

-30 CFR 800.4(d) and 800.23

Section 509(c) of the federal Surface Mining Control and Reclamation Act of 1977 ("Act") provides that, "The regulatory authority may accept the bond of the applicant itself without separate surety...[emphasis added]." The new proposed Part 800.23, however, conspicuously requires no surety or collateral at all. Whereas Congress wisely recognized that large, solvent, stable businesses may not require the services of an outside separate surety, there is no indication that these businesses were meant to "bond" themselves with a mere promise to pay.

Clearly there is a difference between a self-bond "without separate surety" and a bond with no security at all. The term "surety" does not mean "security," but means "guarantor." Therefore, Section 509(c) should be seen as allowing a fiscally responsible operator as being its own guarantor.

This is not to say that a self-guarantor should be allowed to make a non-secured guaranty. Even separate, professional sureties are backed by a minimum ratio of net assets to policy obligations and are further backed by state guaranty funds in approximately 80% of the states. Likewise, a self-guarantor must provide substantive support for his guaranty. This support (ie, security) must at least equal the amount of the bond and must be readily collectible.

An unsecured bond is no more than an operator's stated recognition of an obligation already clearly established by the Act. Accordingly, dropping the requirement for a secured bond would give no force and effect to the word effectively gut the Act's requirement for performance bonds - at least for large operators. If Congress had intended large, prosperous operators to be exempted from the bonding requirement, it could easily have done so. Instead of saying that such operators need no bond, Congress insisted that all operators furnish performance bond, but allowed certain operators to do without separate sureties (cf., securities).

The purpose of a performance bond is not to supplant the operator's obligation to reclaim disturbed areas, but to insure the completion of adequate reclamation in the event of the operator's indisposition and to facilitate the recovery of the costs of reclamation. Although no large, prosperous operator may ever become insolvent whilst operating under a self-bond, a security should be required to provide full reclamation in such an event. Without assets held as security, the regulatory authority would have to stand in line with all the other unsecured creditors of the operator and would receive less than the full face value of the "bond."

It is of little comfort to find (in subsection (c)) that an insolvent, self-bonded operator will be stopped from mining until another (necessarily separate) surety is found. What if no surety were found? Realistically, what surety would willingly guarantee the performance of an insolvent? Disturbed unreclaimed land would be left with no funds for reclamation.

Another benefit of secured bonds is the ease in collection of the amount forfeited when the conditions of a bond are not met. Whether transfer of the collateral asset is accomplished by foreclosure on a lien, by invasion of an escrow account, or by other means; the process is shorter and more certain than suing the operator for payment of the cost of needed additional reclamation, thus reducing the cost of enforcement. Without a secured bond, Section 509(c) would have no more affect than a statement that the government can redo or finish unacceptable reclamation and can require the operator to pay the cost. In fact, this approach has been used in Illinois in other areas (See enclosed Section 9-117 of the Illinois Highway Code.).

For the above reasons, this Department recommends that no unsecured self-bonding be allowed. Specifically, OSM should retain the language in existing Section 806.11(b)(3) and (4).

30 CFR 800.14(a)

The cost of reclamation should be projected for the date upon which the bond would be either released or forfeited. After all, work to be paid by the bond monies would not be started until that time and may be increased because of inflation. An experience construction estimator can give reliable predictions of these future costs. This provision, therefore, should be amended by adding something like, "Reclamation costs shall be calculated for work to commence at the end of the period of liability determined under §800.13, supra."

30 CFR 800.40

Proposed Part 800.40(a)(2) requires that, "the applicant shall submit copies of letters he has sent to jointing property owners... ." This provision does not require the applicant to actually send those letters, but merely requires the applicant to send copies of any letters that may have been sent. Accordingly, this provision should be rewritten to read, "the applicant shall provide notice in writing to adjoining property owners and shall provide copies of such notices to the regulatory authority ...."

Proposed Section 800.40(c)(2) states that no Phase II portion of the bond may be released "until soil productivity for prime farmlands has returned to the equivalent levels of yield as non-mined land of the same soil type in the surrounding area as determined from the soil survey pursuant to Section 507(b)(8) [sic] of the Act." This language is taken directly from §519(c)(2) of the Act with the words "under equivalent management practices" removed from between "surrounding area" and "as determined." Because management practices have such a major impact on yield (second only, perhaps, to weather), it is important that equivalent practices be applied to the reclaimed area. The productivity of the reclaimed site will be determined by comparing its yield with that of unmined sites having the same soil conditions of the reclaimed site. If the operator were allowed to use practices not normally used in the surrounding area on similar soil types (i.e., irrigation and unprofitable fertilizer rates) to raise the yield to an artificially high level, such a comparison would be an "apple and oranges" situation where no meaningful conclusion could be reached. Congress recognized and addressed this problem when it included in §519(c)(2) the language discussed here and specified "equivalent levels of management" in §510(d)(1).

If it really is OSM's intention to limit proof of productivity to information contained in soil surveys, this Department should be immediately notified. Such a position would constitute a major departure from the status quo and would have extremely serious consequences in Illinois.

The language in this proposed rule is ambiguous enough for a reader to believe that soil productivity can only be determined through a soil survey. Because OSM has never supported such a proposition and because soil surveys were never intended as an absolute productivity measure, the ambiquity should be removed. This could be accomplished by changing the above language to read, ".... until soil productivity for prime farmland has returned to the equivalent levels of the yield as non-mined land of the same soil type in the surrounding area under equivalent management practices. Soil types are to be determined from soil surveys pursuant to Section 507(b)(16) of the Act."

30 CFR 800.50

As was discussed under Sections 800.4(d) and 800.23 above, the performance bond requirement was not meant to supplant the oeprator's underlying obligation to reclaim all the land disturbed under his permit. That obligation continues even when the operator's performance bond is forfeited. This rule, therefore, should clearly establish that an operator's liability is not limited to the amount of the performance bond and is not necessarily satisfied by that bond's forfeiture.

Accordingly, the following subpart (e) should be added to proposed Section 800.50:

> "e. In the event the forfeited bond is insufficient to pay for the full cost of reclamation, the operator shall be liable for remaining costs. The regulatory authority may complete, or authorize to be completed, reclamation of the bonded parcel and may recover from the operator all costs of reclamation in excess of the forfeited bond.

Summary of Recommendations

1. §800.4(d) - Delete the words "in lieu of a surety or collateral bond."
2. §800.14(a) - Add, "Reclamation costs shall be calculated for work to commence at the end of the period of liability determined under §800.13, *supra*."
3. §800.23 - Retain the language in existing §806.11(b)(3) and (4) on secured self-bonds.
4. §800.40(a)(2) - Re-write to read, "the applicant shall provide notice in writing to adjoining property owners and shall provide copies of such notices to the regulatory authority ...."
5. §800.40(c)(2) - Insert "under equivalent management practices".

6. §800.50 - Add the following subsection:

> e. In the event the forfeited bond is insufficient to pay for the full cost of reclamation, the operator shall be liable for remaining costs. The regulatory authority may complete, or authorize to be completed, reclamation of the bonded parcel and may recover from the operator all costs of reclamation in excess of the forfeited bond.

Although the state regulatory authorities will make the ultimate decisions concerning performance bonds, an exacting national standard needs to be established in this guideline to faithfully adhere to the principles and language of the Act and to protect conscientious states from unfair competition by states with lax standards. From this Departments' own parochial point of view, it is also desirable for meaning standards to apply to this state because Illinois's enabling statute requires that state regulations be no more stringent than necessitated by the Act.

Thank you for this opportunity to comment. In limiting the Department's comments to the areas listed above, we have focused only on those areas of proposed Part 800 that have the greatest potential for impact on Illinois farmland. Your careful consideration of these concerns will, likewise, affect Illinois agriculture. If this Department can be of any future service, please do not hesitate to contact me.

Sincerely,

George W Tinkham

George W. Tinkham
Section Chief

GWT:bw

cc: Illinois Department of Mines and Minerals

ATTACHMENT A

Section 9-117 of the Illinois Highway Code
(Ill. Rev. Stat. 1979, ch. 121, par. 9-117)

§9-117

If any person injures or obstructs a public highway by felling a tree or trees in, upon or across the same, or by placing or leaving any other obstruction thereon, or encroaching upon the same with any fence, or by plowing or digging any ditch or other opening thereon, or by turning a current of water so as to saturate, wash or damage the same, or by plowing in or across or on the slopes of the side gutters or ditches, or by placing any material in such ditches, or in any way interfering with the free flow of water therein, or leaves the cutting of any hedge thereon for more than 10 days, without the permission of the highway authority having jurisdiction over such highway, he shall be guilty of a petty offense and fined for every such offense not less than $10 nor more than $100; and in case of placing any obstruction on the highway, an additional sum of not exceeding $10 per day for every day he allows such obstruction to remain after he has been order to remove it by the highway authority having jurisdiction over such highway. Any person feeling himself aggrieved or any such highway authority may make a complaint under this Section.

The highway authority having jurisdiction over such highway, after having given 10 days' notice to the owners of the obstruction or person so obstructing, or plowing, or digging ditches upon such highway or interfering with the free flow of water in the side gutter or ditches, of the obstruction, plowing or digging of ditches, interfering with drainage, or of the encroachment of any fence, may remove any ditches necessary to the drainage of an adjoining farm emptying into a ditch upon the highway, or regrade such side gutters or ditches, and recover the necessary cost of such removal or filling of any such ditch owner or other person obsructing or damaging such highway aforesaid, to be collected by the highway authority having jurisdiction of the highway whereon such offense was committed. Any such cost having jurisdiction over the highway adjudged to have been obstructed or injured, and shall be used only for maintenance or construction of public highways under the jurisdiction of that division.

However, this section shall not apply to any person who shall lawfully fell any tree for use and shall immediately remove the same out of the highway, nor to any person through or along whose land a public highway may pass, who shall desire to drain his land, and who shall give due notice to the proper highway authority of such intention, and who shall first secure from such highway authority written permission for any work, ditching or excavating he proposes to do within the limits of the highway. Amended by P.A. 77-2238, §1, eff. January 1, 1973.

ATTACHMENT #7

The Illinois South Project, Inc.

701 North Park
Herrin, Illinois 62948

618-942-6013

November 6, 1980

Nina Rose Hatfield
Assistant Director
Inspection and Enforcement
Region III
Office of Surface Mining
Federal Building and U.S. Courthouse
46 E. Ohio St.
Indianapolis, Indiana 46204

Dear Nina Rose Hatfield,

I am writing this letter as a follow-up to the October 20 meeting between the Office of Surface Mining and the State of Illinois Department of Mines and Minerals. Because I was an observer at the meeting, unable to participate, I would like to express both comments and criticism I had of the meeting discussion, as well as present Illinois South Project's recommendations on how OSM should proceed with the Freeman United Coal Mining Company permit decision.

Though we found fault with other aspects of the permit, for example alternative post-mining land use justification, we will only focus on the prime farmland restoration issue at this time.

I would like to reiterate that Illinois South Project believes this permit will set a long-lasting precedent. The manner in which this permit is handled by the Illinois Department of Mines and Minerals and the Office of Surface Mining will establish the ground rules for approving mining permits on non-grandfathered prime farmland in Illinois for years to come. During the course of the meeting, Mines and Minerals gave no indication that they will proceed any differently with major prime farmland permit applications in the future. If the OSM thinks otherwise, Illinois South Project would like to know specifically what, in OSM's opinion, did the Illinois Department of Mines and Minerals say during the meeting which indicates a change in policy or procedures in the future.

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I would like to take each issue discussed at the meeting and comment briefly. But, before I proceed, my general criticism of OSM at the 20th meeting was that you did not push Mines and Minerals hard enough to document the data that was presented in the permit, especially requesting that Freeman United and Mines and Minerals submit management data on the test plot data used as documentation.

Revegetation

The Illinois Department of Mines and Minerals contends that Freeman United Coal Mining Company will comply with a process for determining if target yields have been met as will be required by the State of Illinois. Illinois South Project has several concerns about Freeman United Coal Mining Company's process for proving revegetation. The Illinois Department of Mines and Minerals and the Illinois Department of Agriculture continue to operate on the assumption that their "formula" for determining yield, based on county yields by soil type, will be the methodology employed by the regulatory authority when the time comes for Freeman United to prove productivity on reclaimed land.

As you well know, this "formula" has not as yet been submitted to the Office of Surface Mining as a "state window" provision for approval in the Illinois Permanent Regulatory Program Plan--the first step in the OSM approval process.

Illinois South Project supports the OSM recommendation to the Department of Mines and Minerals that this permit should propose an alternative plan(e.g. reference areas) for determining target yields for this prime farmland. This is especially important in light of the very low pre-mining yield data submitted for this prime farmland acreage. It appears to us that the yield data for several years was averaged to produce the low yield figure submitted. (There was no management data submitted which could explain the difference in yields per year.) If adequately sized, well managed reference areas in the surrounding area are not required by OSM at this stage of the mining process, Mines and Minerals may continue to use some of Freeman United's pre-mining data or other data they may be gathering on equally poorly managed land under Freeman's ownership, as reference areas for this permit, if the State's "formula" is not accepted by OSM. The simple verbal recommendation given by OSM at the 10/20 meeting does not provide sufficient assurance this practice, which is unacceptable in our opinion, will not become the standard for the state regulatory authority.

Mixing of Soil Horizons and Adequacy of Data Base

Illinois South Project has concerns about the technical basis for Illinois Department of Mines and Minerals' assessment that the B and C horizon can be mixed, in light of the lack of productivi data from existing Freeman United Coal Company Mines, the lack of management data for test plots and other plots used as documentation, and the inappropriate and unsubstantiated use of various independent research materials.

The Freeman United Coal Mining Company did not give adequate data to justify the Illinois Department of Mines and Minerals granting them permission to mix the B and C soil horizons.

Mines and Minerals' assessment that Freeman can mix the B and C soil horizons, using a bucket-wheel excavator and achieve equal productivity is based on Mines and Minerals inspector Dean Spindler's technical assessment of Freeman's performance at other mines.

OSM has yet to question Spindler on the productivity of currently reclaimed acreage at either Freeman's Fidelity or Buckheart mines. OSM did not inquire how much Rule 1104 land at these mines has had bond release. OSM did not inspect this Rule 1104 acreage, to our knowledge, or take core drillings at these "comparative mines" to examine the physical and chemical properties of this B and C soil mix.

The State of the Art of Freeman's reclamation is based only on an observation of an Illinois inspector, not on the current physical and chemical properties of Freemans' Rule 1104 acreage, much less the productivity of this most recently mined and reclaimed land. (Of course, Illinois South Project realizes that this land need only be reclaimed to 90% of its pre-mining productivity and is 10% less than what the Federal Act requires for prime farmland.)

OSM did not point out to the Illinois Department of Mines and Minerals at the October 20th meeting that management data was not supplied for the test plots, particularly the Gale Ranch sites in Fulton County, presented as evidence that land could be reclaimed to 100% of its pre-mining productivity, or that a mix of the B and C horizons would produce equal productivity as a segregation of the A,B and C horizons. For all you know, test plots could have been hand planted and harvested, or irrigated in past years. In our opinion, this issue should have been raised with Mines and Minerals and Freeman United Coal Mining Company should be required to supply this land management data on all plots submitted as evidence that this land can be reclaimed, by Freeman, to 100% of its pre-mining productivity using the farm management practices of the surrounding farms. If this management data is not available, these plots can not be accepted as adequate evidence by the Illinois Department of Mines and Minerals or the Office of Surface Mining.

On page 45 of the Illinois Department of Mines and Minerals' "Synopsis on Conclusions on Reclamation Plan and Public Hearing Comment in the Matter of Freeman United Coal Mining Company, App. No. 902", the Department cites "Reclamation of Surface Mined Land Research, Second Annual Report to the CSRS" by Jansen, Boarst, and Dancer, as documentation which supported Freeman's belief that other suitable material could be used in place of the B and C horizons which is of equal value for the productivity of locally adapted crops.

The Office of Surface Mining officals at the October 20th meeting did not question the Department of Mines and Minerals on the validity of using Dr. Jansen's research as a primary source for justifying the B and C mix. Dr. Jansen has repeatedly claimed that drawing conclusions from his research is premature. I have attached a recent article which quotes Dr. Jansen on this disclaimer. Furthermore, the Office of Surface Mining should be interested to know what Dr. Jansen's yields are this drought-stricken year. Certainly, the picture is not hopeful. Because Dr. Jansen's work was referenced by Mines and Minerals as a primary source of data, the Office of Surface Mining should contact Dr. Jansen to better understand how his research should and should not be employed as documentation of proof that the B and C horizon mix will produce equal or better productivity in Central Illinois than segregation of the A, B and C horizons.

Other documents submitted to substantiate Freeman's ability to mix B and C horizons, e.g. "Reclaiming Illinois Strip Coal Land with Legumes and Grasses", by the University of Illinois Agricultural Experiment Station from page 20 of Bulletin 628 published in April of 1958. should also be analyzed by OSM. A company's ability to grow grasses and legumes on reclaimed prime farmland is very different from producing 100% of pre-mining productivity of corn and soybeans--the crops grown in the area. It appears that Mines and Minerals and Freeman United Coal Mining Company are comparing "apples and oranges" in making this crucial decision. OSM can not let this stand as a precedent.

OSM recognized at the October 20th meeting how McCormick's testimony was "stretched" to make the finding that the B and C horizons could be mixed to produce 100% productivity. McCormick testified that it was possible to reclaim land to 100% of pre-mining productivity in the Federal District Court in Indianapolis, Indiana, and happened to give examples where company's were mixing the B and C in Central Illinois.

McCormick was testifying on whether it was possible to reclaim land to 100% of its pre-mining productivity, not whether the Freeman United Coal Mining Company could mix the B and C soil horizons and achieve 100% pre-mining productivity. Illinois has made a very site-specific conclusion from a very broad statement by McCormick. The conclusion arrived at by the Illinois Department of Mines and Minerals should not be acceptable to the Office of Surface Mining.

In the opinion of Illinois South Project, the Office of Surface Mining has not adequately questioned the documents submitted by Freeman United Coal Mining Company and accepted by Illinois as documentation for mixing the B and C soil horizons. The documentation is sketchy at best and does not guarantee that, "other suitable soil material will create a reconstruction root zone of equal or greater productivity capacity than that which existed prior to mining..." [§716.7 (a) (1) (ii)]

OSM's Experimental Variance Policy

Illinois South is concerned about the inconsistency in OSM's public policy on experimental variances. It is our understanding that the Office of Surface Mining required an experimental variance at Southwestern Coal Corporation's Captain Mine, in order for this Southern Illinois mine to receive a 100 acre variance to mix soil horizons. As we have learned from Bob Holloway, the Southwest employee responsible for applying for and receiving the variance, the process was involved and required the personal approval of the Secretary of the Department of the Interior. Most importantly, the Office of Surface Mining recognized that the mixing of B and C soil horizons on prime farmland was a technology which was still in the experimental stages and therefore required a variance with special monitoring procedures.

In a briefing paper prepared for the Secretary of the Department of the Interior's visit to the Captain Mine in March of 1980, Edgar Imhoff, Region III Director, identified the special nature of the Southwestern Coal Corporation variance, and particularly noted the different potential for reclaiming Illinois soils versus those soils of Central Illinois. In that paper Imhoff noted:

> Recently, (under sec. 711, P.L. 95-87) The Secretary of the Interior approved an experimental reclamation practice for restoring topsoil to a 100-acre test site at the Captain Mine. Intensive monitoring of changing soil and vegetative conditions will yield information that can be applied to similar areas in

> the Southern half of the Illinois Coal Basin. A note of caution is essential in terms of the significance of the Captain Mine: The innovative reclamation practices visible at this mine are probably applicable to many of the other mines and potential mine areas which occur along the edges of the Illinois Coal Basin in Southern Illinois, Indiana and Western Kentucky--on forest-type soils. Agricultural potential of clayey-type soils can be improved, often, by mixing or by exclusion of a hardpan through use of the kind of equipment seen at The Captain. The deep black prairie-type soils of Northern and Central Illinois (e.g. Knox County), however, present challenges that do not seem as easily solved as those at The Captain. The black prairie soils of the great corn-bean belt present different problems for OSM, scientists, and operators." [some emphasis added]

Illinois South Project is in strong agreement with Imhoff's statements about the differences between Southern and Central Illinois soils. Therefore, why did OSM proceed so cautiously and require an experimental variance in Southern Illinois, an area where OSM Region III admits has better potential for soil mixing, while a major new mine permit on prime farmland prairie-type soils in Central Illinois remains unchallenged by the Office of Surface Mining?

Suggested Action for OSM

Based on these questions and issues concerning Freeman United Coal Mining Company's restoration and demonstration plan, Illinois South Project recommends that OSM take the following actions.

(1) Do further research into the documentation presented by Freeman and accepted by the Illinois Department of Mines and Minerals as adequate documentation that a B and C soil horizon mix will ensure equal or better productivity. This includes further analysis of Dr. Jansen's preliminary research findings.

(2) Require that complete management data be provided for all test plot and other yield data which was submitted as documentation. If this management information is not available, or shows management practices different from those used in surrounding areas, OSM should make a finding that the yield data can not be accepted as demonstration of proof.

As stated earlier, it is Illinois South Project's assessment that Freeman United Coal Mining Company has not provided adequate data to justify the mixing of the B and C horizons. OSM should arrive at the same conclusion if you carefully evaluate the data presented by Freeman on the basis of the questions we have raised.

(3) OSM should take the necessary legal action to invalidate Freeman's prime farmland soils restoration plan at the Industry Mine. Because Freeman has not provided the necessary documentation to substitute a B and C mix, the State of Illinois should not be allowed to proceed and continue "reclamation as usual--Illinois Rule 1104" as spelled out in the Industry Mine permit.

If Freeman can not provide adequate data to justify the mixing of B and C soil horizons, the mining company should be required to comply with the requirements of the Federal Act [§515 (b) (7)] and remove and replace the A, B and C soil horizons separately.

(4) OSM must now determine whether the Freeman United Coal Mining Company has provided adequate data to meet the requirements of §510 (d) (1) of the Federal Act.

If OSM is going to allow Mines and Minerals to grant a permit for this mine, we recommend that the entire 1402.2 acres of prime farmland not be permitted at one time, but incrementally and under the experimental variance provision of Section 711 of P.L. 85-87. Our reasoning for this recommendation is as follows.

Freeman United Coal Mining Company, OSM, Illinois Department of Mines and Minerals and Illinois South Project recognize that there is a dearth of field data(which especially includes specific longterm documentation of yields and management) on 100% reclamation of prime farmland in Central Illinois.

Mines and Minerals contended at the October 20th meeting that the data presented to them by Freeman and the Department's own data submission, constitute all the existing Illinois data for reclaiming prime farmland to 100% of its pre-mining productivity and adequately demonstrates Freeman's technological capability. The fact remains that, to date, no company has followed the restoration requirements of §515 (b) (7) of the Act and achieved results which are equivalent to 100% of the land's pre-mining productivity for corn and soybeans in Central Illinois. Therefore, OSM's approach should be a conservative one until an adequate data base exists which can more definitively substantiate whether or not prairie soils can be mined and reclaimed to 100% of pre-mining productivity.

Initially, Freeman United Coal Mining Company must apply to OSM for an experimental variance (as did Southwestern's Captain Mine) for enough prime farmland acreage which will be mined in the first year of operation. OSM and the Illinois Department of Mines and Minerals should establish a joint technically sound and rigorous monitoring program. An annual evaluation by OSM of the chemical and physical properties of the reclaimed prime farmland, as well as specific documentation of the management techniques employed by Freeman and substantiation of initial productivity data shall occur. If OSM and Mines and Minerals are in agreement that Freeman's reclamation is of the quality that could produce 100% of its pre-mining productivity, the second-year's prime farmland area for mining may be permitted. If OSM is not satisfied with the work accomplished, additional prime farmland acreage is not granted a permit. The U.S. Department of Agriculture should also be active in this monitoring process, as well as interested citizenry.

This experimental variance status should continue until reclaimed prime farmland has had the bond released and 100% of pre-mining productivity has been met. If Freeman can accomplish this feat, then larger, 5-year mining permits on prime farmland could be given.

Illinois South Project is not taking a position that Freeman United Coal Mining Company can or can not meet the prime farmland restoration requirements of the Federal Act and regulations. What Illinois South Project is advocating is that the Office of Surface Mining and the Illinois Department of Mines and Minerals proceed with upmost caution until you can establish the kind of data base which leaves no doubt that Freeman United has the technological capability to reclaim land to 100% of its pre-mining productivity.

We would like to be very clear that under the plan we have proposed above, based on yearly permitting of prime farmland experimental variances, acres will be reclaimed by segregating the A, B and C soil horizons and replacing each separately.

We at Illinois South Project hope this letter expresses our concerns and suggestions for remedying those concerns. Those sentences underlined are of particular concern to Illinois South Project. We would like OSM to respond to all the questions and issues we have raised in this letter, but especially those concerns which have been underlined. If you have any questions about our recommendations, please feel free to contact us.

Thank you for your consideration in this matter. We hope that OSM will act conscientiously, conservatively and cautiously in this matter.

Sincerely,
Pam Mavrolas
Pam Mavrolas, Staff Member

cc:
Edgar Imhoff
Ed Grandis
Robert Yuhnke
Jane Johnson
William Morris
Charles Sandberg
Enclosures:

ATTACHMENT #8

Researche Reclaimed land may surpass original

By Evan M. Davis
Of The Southern Illinoisan

Reclaimed Southern Illinois farm land eventually might be as good or better than before it was mined, but the process will take a long time, a University of Illinois soil scientist suggested Tuesday in Pinckneyville.

Ivan J. Jansen, speaking at the annual meeting of the Reclamation Coal-ition, described crop growth experiments he is doing with soil at five Illinois strip mines.

"We have essentially made a younger soil out of it," Jansen said.

The younger soil is not a top-productivity soil, however, and it takes many years to reach that level, Jansen said. Soils mature in nature over thousands of years, he said, and even though scientists can speed the process considerably, it will still take "a very long time" for a soil to reach peak capability.

The famous soil of central Illinois is already at or near peak capability and Jansen said in an interview it is going to be more difficult to reclaim that land to productivity equal to what it had before mining. He said he is unwilling to predict that can be achieved "within our lifetime."

Jansen is optimistic about Southern Illinois soil, however, because it is past its prime — with too much mineral leaching and too much clay — and can be improved with careful reclamation.

Jansen told the Coal-ition he daydreamed long ago about taking soils like that and mixing them with the minerals below to rejuvenate them, but always assumed the cost would be prohibitive.

"Now we have coal to pay the bill," he said. "Let's design the soil we really want, based on what we know about soils."

Jansen reported limited success so far in the 3-year-old experiments. He said he is confident scientists can rebuild the chemical qualities of good soil, but the physical quality is much more difficult to obtain.

> 'We have essentially made a younger soil out of it'
>
> – Ivan J. Jansen

A major problem is water retention. A good soil will have structured itself over the years so that plants can make best use of the water that enters it.

When soil is mined, stockpiled and then replaced on the ground, however, it becomes "young" again in that its water-control structure is disrupted. If the soil is loose enough, it eventually can rebuild its own soil structure, but Jansen is especially concerned that the heavy machinery used in reclamation can pack the soil so tightly that it cannot regain its good structure.

Jansen's test plots are producing varied results, from no yield in worst conditions to 191 bushels of corn per acre in the best — irrigated central Illinois land. In some cases, corn on reclaimed land without topsoil did better than corn on topsoil, but Jansen believes those were coincidences caused by late-developing non-topsoil corn maturing in a lucky break in the weather.

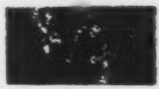
Across the board, Jansen has found the long, hot dry spells among the most critical factors in his experiments.

"We are much more susceptible to weather stress on the newly reclaimed soils," he said.

Before Jansen's talk, the Coal-ition elected the following officers: President Vernon Caupert, rural Cutler; Vice President Sharon Kowalzik, Carbondale; Secretary Victor Provart, Pinckneyville; and Treasurer Alvin McMasters, rural Sparta.

Undermining the American Farm

Allison Engel



HEN YOU DRIVE BY the green, checkerboard fields of corn and soy beans near this southwest Illinois town, they appear orderly and tranquil. But hundreds of feet beneath the calm surface of prime farmland here that sells for as much as $3,200 an acre, there is a different world—a beehive of men, materials, and machinery digging out soft, high-sulphur coal.

Above ground, a casual onlooker would be hard pressed to notice anything amiss, but farmers know every ridge and valley of their crop lands. And many of those who have had coal extracted from beneath their farms are angry about the consequences. The mining, they say, is causing their land to sink, disrupting drainage and reducing the harvest.

Sinking, or "subsidence," may take decades to show up after farmland has been mined underground. "I'm concerned that we are building time bombs for the future," says Jim Frank, the head of Illinois' Division of Natural Resources.

Underground mining is not new in the agricultural midwest, but as this country's appetite for home-grown energy has increased, the number and scale of underground projects have grown accordingly. The stepped-up activity comes at a time when the pressures of urban development, new highways and soil loss due to erosion have placed good farmland at an unprecedented premium.

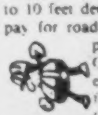
The clash between using land for food or energy production is at its fiercest in Illinois, an immensely rich agricultural state that also happens to have more soft coal undergound—162 billion tons—than any other state in the nation. Between one-fourth and one-half of it is considered recoverable, and last year Illinois mined 63 million tons of coal, making it the country's fifth largest producer. But Illinois is not alone. In the wheat fields of western North Dakota, the alluvial valley hay ground in Wyoming and Montana, corn fields in Western Kentucky, grain ground in southwest Indiana and parts of Missouri and Iowa, similar battles rage over both strip and underground mining on farmland.

An accurate count of the acres of crop land affected nationwide is hard to come by. The U.S. Bureau of Mines estimates that more than 8 million acres of all types of land have been undermined across the country, and that sinking has affected more than 2 million of those acres. In Illinois, the state Department of Mines and Minerals' rough estimate is that of the more than 750,000 acres of land statewide that is undermined, more than 500,000 acres of it is prime farmland.

Carl Behme, whose farming partnership owns 1,500 acres and raises 4,000 hogs near Carlinville, has had first-hand bitter experience with mining under his cropland. The coal rights under part of Behme's land were sold in 1913—years before he was born. In 1977, Monterey Coal Co., a division of Exxon Coal, began mining under his ground. Almost immediately, Behme said, an 80-acre corn and soybean field began to experience unprecedented problems.

"Water used to drain in the ditches by the railroad tracks on one side," he explained, pointing. "Now, it goes in the middle of the field and sits there. This land was so flat that the former owner used it as a landing strip. I'd hate to try and land a plane here now."

In 1978, the road adjacent to the field developed large cracks and flooded, making it impassable for several months. "It looked like an earthquake hit," Behme said, pulling out pictures of sinkholes up to 10 feet deep. The coal company did pay for road repairs, but the drainage problems have persisted. One nearby farmer has erected a sign on a 25-acre field: "Site of Monterey Coal Co. Sink Number One," in disgust over no longer being able to farm the field.



Behme and Monterey are trying to negotiate damages for crop losses, but he is not ruling out the possibility of taking the company to court. "And what's going to happen to our tax base when the coal companies leave?" he asked. "We're going to be dependent on land that's deteriorated."

George L. May, Monterey's general manager, readily agrees that subsidence from his mines' operations cause Behme's problems, but disagrees about the extent of the damage. "Land structures above mines are unpredictable," he said. "But we have engineering plans designed to minimize the disruption to the ground."

Subsidence of farmland is often not visually dramatic, although the problems can be severe. For example, drainage tile lines can cross several farms, meaning that charges in one farm's drainage can affect land miles away. Also, underground mining can draw down an area's water table, and even drain wells.

In 1978, after more than 60 homes, four schools, a church, airport, dam, cemetary, and several commercial buildings in southern Illinois were severely damaged by mine subsidence, the Illinois legislature passed an insurance program to protect against losses from mine sinking. The law applies only to structures, however, not to open land.

The Illinois Farm Bureau supports the concept of designating some prime crop land as unsuitable for mining. Taylor Pensoneau, vice president of the Illinois Coal Association, the state's trade group, says it would be impossible for the industry to go along with more restrictions on mining under or on prime farm land. Pensoneau said coal companies already have "a heck of a time complying with regulations concerning restoration of prime farm land," such as those in the 1977 Service Mining Control and Reclamation Act, which was recently upheld by the U.S. Supreme Court. Restoring farm land to a condition equal to or better than it was before mining, as the act requires, "technologically, is almost impossible," he said.

Said Jim Frank of the Illinois Natural Resources Division, "I see it like the issue of sanitary landfill in the '50s. We took garbage by a river, dumped it, covered it with dirt and then, down the road, we had a Love Canal. I think it's where we are now with underground mining and prime farm land."

Farmers, moreover, are concerned that Interior Secretary James Watt's plans to abolish the five regional offices of the Federal Office of Surface Mining and severely cut the department's inspection divisions mean the 1977 Reclamation Act will be gutted, regardless of the Supreme Court decision.

And so the battle rages on, fueled not only by competing claims on America's food and energy needs, but also by the high financial stakes involved on prime farm land around towns like Carlinville. Not long ago, according to John Terret, who advises farmers on coal leases, there were a lot of outright sales in Illinois at $50 an acre for coal rights. "Now," he says, "the price has gone well over $1,000 an acre." ■

PNS Pacific News Service

Allison Engel is the Midwest bureau editor for PNS.

Attachment # 10

The Macomb Daily Journal, Wednesday, October 7, 1981

Agronomist explains soil reclamation at area coal mine

By NATHAN HADWEN
Journal Staff Writer

VERMONT—Reclamation of strip-mined topsoil is a long and expensive process, the final results of which are not yet known, according to University of Illinois agronomist, Ivar Jansen.

Jansen demonstrated Tuesday how he is trying to make post-mine soil agriculturally productive at the Amax Sun Spot coal mine, near Vermont.

Jansen added that in some cases reclaimed soil could be better than the original soil surrounding it.

Jansen is working on a five-year research contract of $1 million from five Illinois mine companies, one of which is Amax.

The study is five years old and is the largest reclamation project for row crops in the nation. One of the biggest problems is that obtaining results on which to base steadfast conclusions takes a long time.

"Five years of reclamation research is like three months work in some other areas, because the effect of time on soil productivity is such a crucial factor," Jansen said.

Corn on the site is expected to yield 80 bushels per acre this year, according to Jansen. Neighboring farmland which was not mined should yield 130 to 150 bushels.

HE ADDED THAT it takes good weather conditions for the soil to develop a nutrient-packed quality. "Newly reclaimed land is highly susceptible to drought stress," he said.

The agronomist informed a gathering of press representatives that the reclamation of surface-mined land costs more than even the best agricultural land is worth.

Strip-mining breaks down the natural structure of soil even if each layer of the soil is saved and replaced in its original position. One objective of the research is to find ways of creating an artificial soil structure that will provide a good plant root environment while the natural structure redevelops slowly.

"Surface mining and reclamation are costly and consumers are paying most of those costs. It's important that we protect the productivity of land that is to be surface mined. It is also important that only reclamation methods that are effective be used to give consumers their money's worth," Jansen said.

A CRUCIAL step in the soil construction effort is selecting the best material for use in building each layer of the new soil. Most mine sites in Illinois have a variety of alternative materials from which to choose.

Jansen's results suggest subsoils that are mixed with deeper materials eventually may be superior to some of the natural soils of the area. Studies on such elements as rototilled shale are not yet conclusive, however.

Many of the natural soils in Western Illinois are excellent and there is no reason to expect that these soils could be improved, Jansen said.

The 1.6 acre plots at the Sun Spot mine are divided into sections to test how different treatments affect production. In some of the sections, three feet of topsoil is replaced with materials stripped from nearby land in the coal-mining effort. In others, the land is left as is, with earth formerly from 20 feet down resting on the surface.

In this case the compaction of the soil is such that, "Plants are unable to take up phosphorous fast enough. Microbial imbalances make the land practically sterile."

The microbial population, which plays a role in the nutrient uptake and growth of plants, returns to a more favorable balance. Organic matter slowly accumulates and soil structure begins to develop with wetting and drying, freezing and thawing.

AFTER building new soil conditions on the test plots, Jansen said, "The most rapid improvement is in the first three years, then it tapers off."

Susceptibility to heat and water stress persists longer than microbial imbalances, but at this point researchers cannot say how much longer.

Jansen noted that a corn hybrid has not been found which is particularly suited to strip-mined land.

The researchers are growing corn and soybeans at five sites in Illinois on mined land that has been reclaimed in different ways to determine the effect on soil productivity.

Soybean yields have ranged from 0 to 41 bushels per acre. Corn yields ranged form 0 to 155 bushels per acre without irrigation and from 142 to 191 bushels under irrigation. The Illinois five-year averages are 35.1 bushels an acre for soybeans and 109 bushels an acre of corn.

The lowest yields occurred in 1980 when severe drought and heat stress led to crop failure at some sites, Jansen said. Some of the yield variations also were due to reclamation methods.

Yields on newly reclaimed lands were equal in some instances to undisturbed land but generally they were lower.

THE RESEARCH PLOTS are also located near Eads, Marissa, Norris, and Percy.

The other companies participating in the project are Consolidated Coal, Freeman United Coal, Peabody Coal and Southwestern Illinois Coal.

Federal law requires the reclamation of prime farmland after surface mining.

ATTACHMENT #11

P. O. Box 298
Macomb, IL. 61455

December 6, 1980

Mr. Charles Sandberg
Office of Surface Mining
40 Old State Capitol Plaza N.
Springfield, IL. 62701

Dear Charles:

In reference to our response letter on the Freeman United Coal Company Industry Mine, Application No. 902, we have the following comments.

1. Since loess is a fairly homogeneous mixture of wind blown material which has similar mineralogical, chemical and textural properties, it is our opinion that a mixture of B horizon and C horizon can produce a soil medium which is equal to or greater in productive capacity of that which currently exists. Such a mix, if done properly, would produce a more youthful soil which is higher in base saturation.

4 From a productivity standpoint, an analogy can be presented by using similar deep-loess, dark, imperfectly drained, soils in a weathering-time relationship. For example:

(Young)————————————————————→(Old)

Joy———→Muscatine————→Ipava————→Herrick————→Cowden

In this sequence, Joy is considered to be the youngest soil with weak pedogenic development. As we progress thru a time and weathering cycle, we observe a high clay concentration in the subsoil and strong pedogenic development as seen in Herrick and Cowden soils. Although these soils are highly productive they are considered to be past their peak productive levels.

Theoretically, by mixing unweathered C horizon material (loess) with a weathered B horizon in a Herrick soil, we could produce a soil which has similar textural and chemical properties as a Joy or Muscatine soil. Of course, pedogenic development would be absent. As long as bulk density is not significantly increased this should not present a serious problem for root development. Most of the soils (Keomah, Clinton, Ipava, Denny, Herrick, Virden, Clarksdale) identified as prime farmland in the Industry Mine permit area are in the same weathering time state as the Ipava and Herrick soils shown in the example. In other words, the soils are either at or just past their peak productive levels. With peopper soil handling, reconstructed farmland will, in time, reach production levels equal or surpassing current levels on existing prime farmland.

2. In reviewing permit application submittal #902, we now believe that Freeman United Coal Mining Company is placing a different interpretation on what is C horizon than the Soil Conservation Service interpretation. Based on information provided in Application #902, we assumed that C horizon was a single lithologic unit (loess) in which the prime farmland soils developed. In technical descriptions (Ref. Agriculture Handbook #18, pp 175-176 Supplement 5/62) Roman numerals are prefixed to the master horizon or layer designations to indicate lithologic discontinuities either within or below the solum. The first, or uppermost, material (which in this case is loess) is not numbered, for the Roman Numeral I is understood; the second contrasting material is numbered II, and others encountered are numbered III, IV, and so on consecutively with depth. For example: A, B. C, IIC, IIIC, etc. These lithologic discontinuities were not specifically mentioned and the data supplied did not suggest the possibility of their inclusion.

If Freeman's B and C horizon mix was meant to include all unconsolidated geologic deposits below the B horizon, we feel that the mixture would result in a reconstructed soil which will not have equal or greater productive potential as the original prime farmland soils. We base this on the following factors:

A. Materials below the C horizon (loess) of the soils identified consist of a highly variable mixture of paleosols, glacial tills, and interbedded sands and gravels.

B. Assuming homogeneous mixing of these materials was possible, the resultant mixture would have a significantly higher sand and coarse fragment content than the original material. This net mixture would have less available moisture. Studies by the University of Illinois (Circular 1156) indicate that as sand and coarse fragments increase in a silty (loess) soil, productivity decreases, all else being equal.

C. Since the soils present today do not contain restrictive features such as clay-pans, fragipans, sodium, etc., and are some of the most productive soils in the state, soil improvement cannot be expected as would be the case on several soils in southern Illinois.

3. Our determination was based entirely on the data provided on the physical and chemical characteristics of loess material in the C horizon as we interpret C horizon. Our decision was not based either on mining operations and procedures or on any productivity information.

William J. Hartman
Area Conservationist

cc: D. Johnson, SCS, Champaign
E. Voss, SCS, Champaign

STATEMENT OF

ROBERT W. HOLLOWAY
MANAGER, LAND RESOURCES

SOUTHWESTERN ILLINOIS COAL CORPORATION
A SUBSIDIARY OF ARCH MINERAL CORPORATION

BEFORE

SENATE GOVERNMENTAL AFFAIRS COMMITTEE
ENERGY NUCLEAR PROLIFERATION AND GOVERNMENT PROCESSES SUBCOMMITTEE

OCTOBER 22, 1981

Good morning, my name is Robert W. Holloway, Director of Land Resources for Arch Mineral Corporation.

In 1976, at the direction of the President of Arch Mineral Corporation, Mr. Gerald Patrick, intense row crop experimentation was started at the Captain Mine. The mine is located at Percy, Illinois. Coal was mined and the land was reclaimed to prime farmland before P.L. 95-87 became law.

I am pleased to report that I have grown corn, soybeans, wheat, alfalfa, peach and apple trees, 24 different varieties of French hybrid grapes and annually produce 3 tons of honey on reclaimed mined land. Grapes planted in March of this year have grown a remarkable 14 foot in vine length. Wine will be produced next year.

Each year yields have increased on the Patrick Research Plots. In 1981, the corn and soybean plots were supervised by Dr. Joe Jones and Dr. Ferrel Olson, Department of Agriculture Science, Southern Illinois University. The average corn yield was 129 bushel per acre and the average soybean yield was 35 bushel per acre.

During the next three years Dr. Jones will continue his research at the Captain Mine by looking into the possibility of mixing organic materials with the clay based subsoil to actually create new topsoil. The intent of this OSM approved research project under Sec. 711 of P.L. 95-87 is to evaluate soil replacement methods as a way to reduce reclamation costs and still maintain or improve the food producing potential of mined soil.

In 1977 Dr. Ivan Jamsen and other University of Illinois Soil Scientists began soil reconstruction work on reclaimed land at the Captain Mine and four other Illinois mines. Dr. Jamsen's research has been expanded to testing different mixtures of different depths of the A, B, and C horizons of soil. His work also has been approved by OSM under Sec. 711 of P.L. 95-87. Yields on the Jamsen plots over the last five years in Illinois for corn ranged from 0-155 bushels per acre and for soybeans ranged from 0 to 41 bushels per acre.

I am submitting for your review three published scientific papers of Dr. Jamsen. The papers conclude that there is evidence to expect that post-mine soils carefully constructed by blending selected subsurface horizons to dilute or favorably amend undesirable material which will eventually be superior to natural soils in some areas. Further work is needed to determine the productivity of such contructed soil under field conditions. This work has begun.

At the Captain Mine, we are removing two seams of coal and are "Manufacturing" a brand new soil that will increase crop growth by enhansing the chemical and physical properties of the reclaimed land. Our soil reconstruction process could be compared to a mechanical glacier. We are now able to unlock the hidden physical and chemical secrets of soil that have eluded the very best farmers in Southern Illinois. In fact, we have actually mined two seams of coal and changed the low productive non-prime farmland soil into highly productive prime farmland soil.

We at Arch support good and sound reclamation and the principles of P.L. 95-87. However, I must point out that it is counterproductive to have unreasonable time constraints for reclamation and tests for productivity. I sincerely believe that the intent of Congress was to allow a Company, which acts in good faith, the time to reclaim the land according to sound agronomic principles. The test for productivity should be achievable after field testing. If not, a yield standard set too high, will become a defacto moritorium on mining.

The agricultural academic and coal industry are both on a high learning curve. There is no rational reason to set an arbitrary cut-off date for the prime farmland grandfather clause, arbitrary dates for reclaiming affected acres and even less justification for utilizing untested methods for assessing productivity. No good farmer would work in his fields in unfavorable soil conditions like we in the mining industry must do just to be contemporaneous.

Congress has a legitimate and proper role as regards to oversight. What Congress should oversee is the results of regulations and policies set by the executive agency vested with the authority to administer the law. OSM should be given the latitude to draft and implement fair and flexible regulations and the industry given time to comply. From my brief encounter with OSM Director Harris during his recent visit to Illinois, I believe that he intends to uphold and enforce P.L. 95-87 in a way that is fair to all parties concerned.

In summary, I believe that there can be compatability between those having interest in agriculture and energy. It is now possible to double crop coal and corn from the same acre the same year. I have done this.

We Americans now control approximately 1/2 of the feed grain and 2/3 of the soybean supply of the world. We also have more coal than all of Europe, Asia, South America and Africa combined.

We should be vigorously pursuing export markets for both agriculture products and coal which would help our unfortunate balance of payments. We not only could pursue peace in the world with food but we could pursue peace in the world with our energy. Both can be accomplished without environmental harm and would greatly stimulate our economy.

On October 23, 1981, the Southern Illinoisian reported on it's editorial page that "There is more evidence that the dire warning, it can't be done, is proving false as regard to reclaiming strip-mined land." The editor went on to say that we can be optimistic that agriculture and coal mining can co-exist in Southern Illinois.

For your review I am submitting pictures of our reclamation and mining process which is like a mechanical glacier, reclamation data that has been printed in scientific journals and samples of honey which is symbolic of our double cropping principal.

In behalf of Mr. Gerald Patrick, President of Arch Mineral Corporation, I wish to invite you and any other member of Congress to see coal mining and prime farmland restoration at the Captain Mine near Percy, Illinois. Let's replace Confrontation with Cooperation and win the war on Energy.

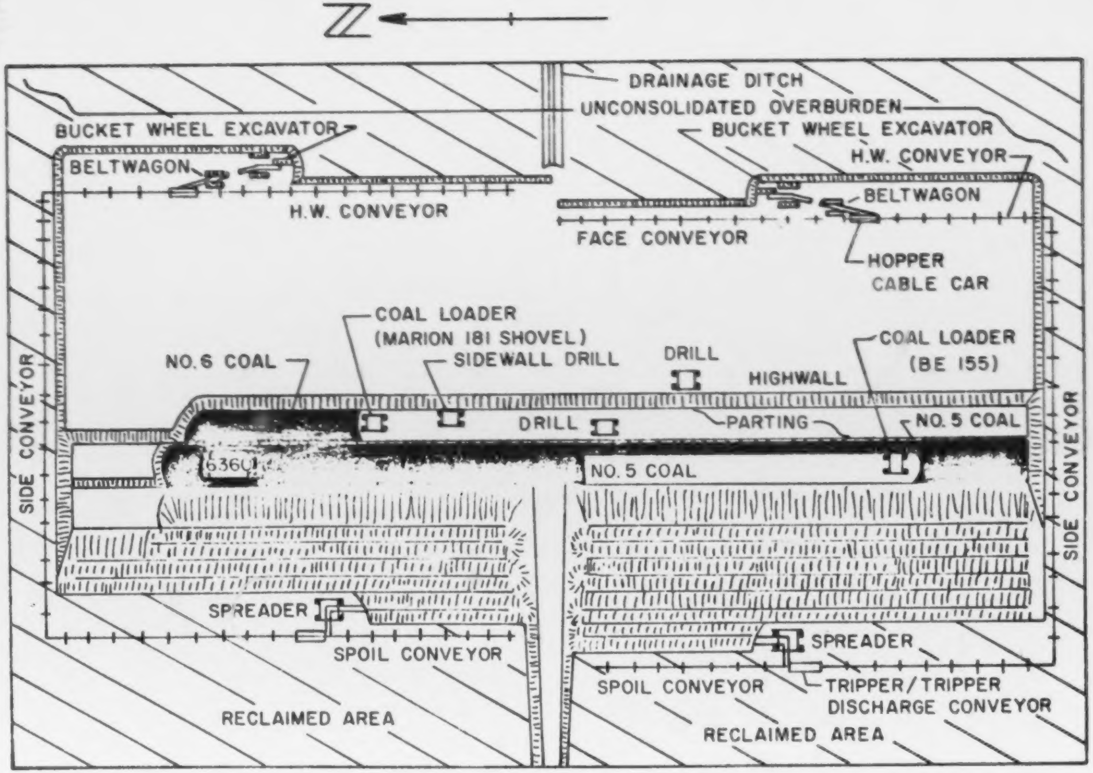
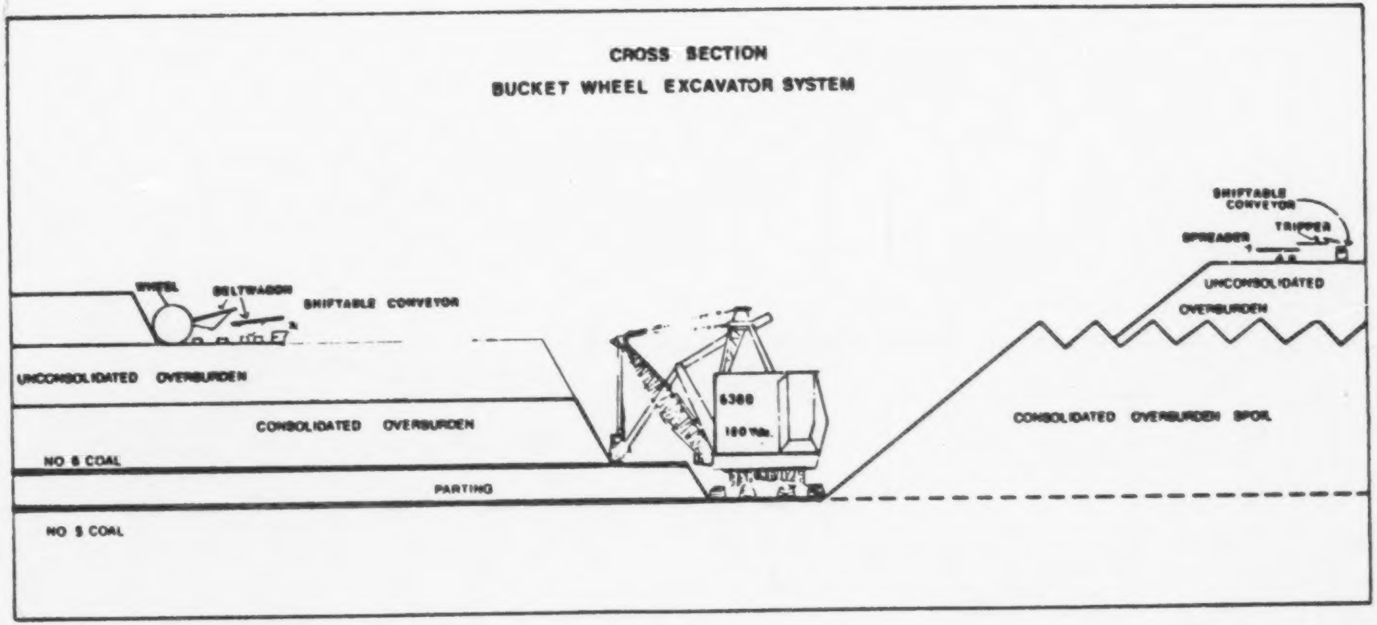


FIGURE 1

PIT LAYOUT



CROSS SECTION

BUCKET WHEEL EXCAVATOR SYSTEM

FIGURE

Strip-mined land can be recycled for farming uses

Belleville News Democrat 10-9-81

From Staff, Wire Reports

Preliminary research shows old strip mines can be reclaimed for productive farm land, says a University of Illinois agronomist.

Agronomist Ivan Jansen, head of the research team, Tuesday reported findings from five mine reclamation projects at strip mines at Astoria, Eads, Marissa, Norris and Percy. The project will continue for another five years, he said.

The Marissa strip mine has been in production since 1963 by Peabody Coal Co. It is still operating but has mined out the area where the small research plots are located, said Don Simpson, a Peabody spokesman.

The first crop year for the project was in 1978 and since then yields per acre have varied at the five sites from zero to 41 bushels for soybeans, zero to 155 bushels for corn without irrigation, and 142 to 191 bushels for corn with irrigation, Jansen said.

Average normal yields for the two crops over the last five years in Illinois have averaged 35.1 bushels per acre for soybeans and 109.8 bushels per acre for corn, he said.

Jansen said yields on the reclaimed sites were generally lower than on normal cropland.

About 45 percent of the coal produced in Illinois comes from strip mining.

A total of 13,510 acres in St. Clair County have been affected by strip mining. Madison has only seven acres affected and Monroe has none.

"We have learned we can grow good corn and soybeans on newly reclaimed land under favorable weather conditions," Jansen said at a news conference.

The research shows the use of a blended soil mixture allows corn and soybeans to grow while the soil structure rebuilds itself after stripmining, Jansen said.

Ben Jones, associate director at the U of I Agricultural Experiment Station at Urbana, said the project addresses the "real world problems" of producing energy while maintaining food sources.

"Surface mining and reclamation are costly and consumers are paying most of those costs," Jones said. "It costs more to reclaim surface-mined land than even the best agricultural land is worth. Yet, we must protect our future capacity to produce food."

During the five-year study, Jansen said strip-mined areas were rebuilt using a mixture of subsoils and materials from deeper underground, then topped off with the original topsoil. He said this mixture provided a good plant root environment while the natural structure redevelops.

In fact, Jansen said the mixture may eventually become superior to some of the undisturbed soils around the strip-mined areas, particularly in southern Illinois.

He said soil in the southern part of the state — where more than 75 percent of the state's surfaced-mined coal is produced — are strongly acidic and have nutrient-deficient subsoils. These problems can be alleviated in some cases, he said, by adding carefully selected materials from beneath the natural soils.

One drawback, Jansen said, is newly reclaimed soil is more susceptible to weather conditions, especially drought.

Another problem is the lack of microorganisms in the materials from beneath the subsoils. In spots where the topsoil was not replaced, Jansen said, the plots showed "severe plant stunting."

"Natural soil is full of microorganisms, which play an important part in plant growth," he said. "So you get severe crop stunting the first year, but by the second year the microbial population is re-established."

Ideally, Jansen said, the reclaimed land should be used for forage crops for several years before corn and soybeans are planted. But, he said, it is possible to immediately begin row cropping.

Half of the 64 plots at the Astoria field were planted in corn and soybeans while the remainder produced hay.

"The best management, we feel, is to let it lay a few years and then go into row-crop production," Jansen said. "If I had a market for hay, I'd let it lay four or five years. If I didn't have a market for hay, I would go right into corn and soybeans."

Normal tillage methods were used on the experimental plots but an increased amount of fertilizer was used to to promote a rapid buildup.

With the help of a $1 million grant from five major coal companies — Amax Coal, Consolidation Coal, Freeman Coal, Peabody Coal and Southwestern Illinois Coal — the University of Illinois research project will continue another five years, Jansen said. It is the largest reclamation project for row crops in the country.

Oct 23, 1981

Southern Illinoisan

A Lee Enterprises Newspaper

Opinions

John C. Gardner
Publisher
Peter W. Selkowe
Editor

Let flowers bloom on reclaimed land

THERE IS more evidence that the dire warning "it can't be done" is proving false as regards reclaiming strip-mined land.

A new study by the University of Illinois shows that land recovered from surface mining can be restored to agriculture. And crops grown on reclaimed soil in Southern Illinois might increase in yields.

The U of I study reinforced many of the points noted by scientists at Southern Illinois University-Carbondale, who in working with area coal companies have found that restored soil can be better than the original

For Southern Illinois, the experts say that when mixed with other soils, the clay abundant in this area helps hold root systems better. Our region accounts for more than 75 percent of the surface-mined coal in the state.

The latest study is more good news for environmentalists and coal companies who have been battling over surface mining regulation. For years, many people in the coal industry have said it would be too difficult, too expensive and perhaps impossible to restore full agricultural potential to strip-mined land.

Although confirming many discoveries made earlier by SIU-C, the U of I research comes at a good time because Interior Secretary James Watt has promised a full scale review of Office of Surface Mining regulations. The suspicion is that the Reagan Administration intends to loosen requirements of the 1977 Strip Mining Act.

Although the current law is quite strict on how land must be reclaimed, there is flexibility that allows experimentation with methods not specified by the act — such as the beneficial mixing of soils as cited in the U of I study.

The coal companies that financed the U of I report are providing another $1 million to continue research for five more years. But for now, we can be optimistic that agriculture and coal mining can co-exist in Southern Illinois.

KEY-AG

Key Agricultural Services, Inc.
114 Shady Lane, Macomb, Illinois 61455 • Tel: (309) 833-1313

October 16, 1980

Mr. Robert Holloway
Southwestern Illinois Coal Corp.
R.R. #1
Percy, Illinois 62272

Dear Bob:

Given below are the yields on the various areas and plots at the Captain Mine. All corn yields are corrected to 15.5% moisture and soybean yields to 13.0% moisture.

I. No-till irrigated corn.

Ten yield samples were taken with the combine. Four rows, 50 feet long, were harvested in each sample. The row spacing was 30 inches.

Sample 1 -- 48.6 bu/A
2 -- 50.9 bu/A
3 -- 27.0 bu/A
4 -- 40.9 bu/A
5 -- 8.5 bu/A

Sample 6 -- 48.6 bu/A
7 -- 55.6 bu/A
8 -- 7.7 bu/A
9 -- 40.9 bu/A
10 -- 30.1 bu/A

The average yield on this area was 35.9 bu/A.

II. Irrigation study on corn and soybeans

A. Irrigated corn plots

Rep I -- 100.3 bu/A
II -- 125.0 bu/A

Rep III -- 112.7 bu/A
IV -- 72.5 bu/A

Average yield -- 102.6 bu/A.

4 rows each 25 feet long were harvested in each rep.

B. Unirrigated Corn plots

Rep I -- 3.1 bu/A Rep III -- 4.6 bu/A
II -- 4.6 bu/A IV -- 3.1 bu/A

Average yield -- 3.85 bu/A

4 rows of 25 feet each were harvested in each rep.

C. One Irrigation

Rep I -- 101.9 bu/A
Rep II -- 80.2 bu/A

Average yield -- 91.1 bu/A

4 rows of 25 feet each were harvested in each rep.

D. Irrigated soybean plots

Rep I -- 37.9 bu/A Rep III -- 38.9 bu/A
II -- 35.9 bu/A IV -- 20.2 bu/A

Average yield -- 33.2 bu/A

15 feet wide by 50 feet long were harvested in each rep.

E. Unirrigated soybean plots

Rep I -- 20.7 bu/A
II -- 16.7 bu/A

Average yield -- 18.7 bu/A

15 feet wide by 50 feet long were harvested in each rep.

F. One irrigation

Rep I -- 32.5 bu/A Rep III -- 21.7 bu/A
II -- 19.7 bu/A IV -- 14.8 bu/A

Average yield -- 22.2 bu/A

15 feet by 50 feet harvested in each rep.

III. Reclaimed vs Unmined check study

A. A horizon over B + C reclaimed area -- corn

Rep I -- 3.1 bu/A Rep III -- 9.3 bu/A
Rep II -- 10.0 bu/A Rep IV -- 2.3 bu/A

Average yield -- 6.2 bu/A

4 rows 50 feet long were harvested.

B. Unmined check -- corn

Rep I -- 52.5 bu/A Rep III -- 57.1 bu/A
Rep II -- 55.6 bu/A Rep IV -- 54.0 bu/A

Average yield -- 54.8 bu/A

4 rows 50 feet long were harvested

C. A horizon over B + C reclaimed area -- soybeans

Rep I -- 6.9 bu/A Rep III -- 6.9 bu/A
Rep II -- 5.9 bu/A Rep IV -- 5.4 bu/A

Average yield -- 6.3 bu/A

Harvested area -- 15 feet wide by 50 feet long

D. Unmined check -- soybeans

Rep I -- 21.2 bu/A Rep III -- 14.8 bu/A
Rep II -- 28.6 bu/A Rep IV -- 25.1 bu/A

Average yield -- 22.4 bu/A

Harvested area -- 15 feet wide by 50 feet long

If you have questions, please call.

Sincerely,

Robert G. Palmer, Ph.D.
Certified Professional Agronomist
Certified Professional Soil Scientist

ROBERT G. PALMER

RGP:dlp

Southern Illinoisian 10/10/81

Coal firms give $1 million for reclamation research

Five coal companies have donated $1 million to the University of Illinois for five more years of research in reclamation of surface-mined Illinois farm lands.

The companies, Amax, Consolidation, Freeman United, Peabody and Southwestern Illinois, are allowing Prof. Ivan Jansen and his team of agronomists to continue research on how best to re-build Illinois' rich soils for soybean and corn production.

"It costs more to reclaim surface-mined land than even the best agricultural land is worth," Jansen said in a U of I news release. "Yet we must protect our future capacity to produce food."

The release said about 5,000 acres of Illinois land is surface mined each year.

A 4-year-old federal law requires coal companies to restore all mined farm land to its original productivity, something scientists have said they are not sure they can do with the especially rich soils of central Illinois.

Jansen said mining breaks down soil structure, even when the layers are saved and replaced in their original positions. His research tries to create artificial soil structures that will be good for plant roots while the natural soil structure redevelops over time.

In Southern Illinois, Jansen suggests, reclamation that mixes deeper soils with the region's rather poor subsoils can produce a final soil superior to that which was mined.

Reprinted from the *Journal of Environmental Quality*
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677 South Segoe Road, Madison, WI 53711 USA

Greenhouse Evaluation of Solum and Substratum Materials in the Southern Illinois Coal Field: I. Forage Crops[1]

W. S. DANCER AND I. J. JANSEN[2]

ABSTRACT

More than 75% of the surface-mined coal in Illinois is produced in southern counties, where soils have a very strongly acid and nutrient-deficient subsoil that limits root penetration and water availability.

Slightly acid (pH 6.2) C_1-material and mildly alkaline glacial till (pH 7.5) overburden strata are readily available in these coal fields, and could be used in post-mining soil construction. Our objective is to identify overburden materials that can be used as an alternative to the very strongly acid (pH 4.7) subsoil. This study compared the growth of three forage test crops on representative Weir silt loam topsoil (Ap) and subsoil (B_t), with deeper C_1-material (B_3 and C_1 strata), and Illinoian glacial till (IIIC stratum). All of the overburden materials studied significantly responded to lime and fertilizer with topsoil supporting the best plant growth without amendment.

The very strongly acid subsoil was shown to be inferior to the leached C_1-material found immediately below it. Amendment with high levels of lime and fertilizer was required to achieve maximum productivity on the native subsoil. Blending the subsoil with the C_1-material was shown to be a viable alternative to liming it, and provided a more desirable texture as well.

Additional Index Words: **land reclamation, surface mining, minesoil, minespoil, soil reconstruction, claypan soils.**

Dancer, W. S., and I. J. Jansen. 1981. Greenhouse evaluation of solum and substratum materials in the southern Illinois coal field: I. Forage crops. J. Environ. Qual. 10:396–400.

The Federal Surface Mining Control and Reclamation Act (Public Law 95-87), passed in 1977, requires that the A and B horizons be segregated and replaced in their normal sequence where prime farmland soils have been disturbed by surface mining for coal. This law allows substitution for the subsoil if alternative materials can be shown to be texturally and chemically suitable, and equally or more favorable for plant growth (19). Hence, there is a challenge to identify the overburden materials most suitable for plant growth.

More than 75% of the surface-mined coal in Illinois comes from the southern portion of the state. In southern Illinois, most of this coal is produced in Randolph and Perry Counties and in adjacent areas of St. Clair, Jackson, and Williamson Counties.

Prime agricultural soils disturbed by the surface-mining of coal in southern Illinois most commonly belong to the Hosmer-Stoy-Weir and Oconee-Cowden-Piasa associations (7), but soils of the Ava-Bluford-Wynoose and Hoyleton-Cisne-Huey associations are usually disturbed by surface operations in the eastern portions of Perry, Jackson, and Williamson Counties. Soils of these latter associations are formed on 0.8–1.3 m of weathered loess and do not have the deeper unleached C_1-loess substrata found further west, as shown in Fig. 1.

A Weir silt loam (Typic Ochraqualf) was used for the studies presented in this paper, and therefore the conclusions are most applicable to soils formed on deeper loess having the C_1-loess substrate, e.g., those belonging to the Hosmer-Stoy-Weir and Oconee-Cowden-Piasa associations. Most of these soils have acid subsoils which are high in clay (40%), highly plastic, and poorly aerated when wet. These subsoils tend to be only slowly permeable and, when dry, restrictive to root penetration (6). Occasional "slick spots" that have natric subsoils are encountered, and adversely influence crop yield and intensify management problems. Many of these soils overlie deeper materials which appear more suitable for growing crops (1, 14, 15, 17). Some degree of weathering may also be a prerequisite for the development of properties favorable for plant growth, because the more alkaline and calcareous C_1 horizons of arid areas are generally inferior to their associated subsoils (10, 11). Furthermore, rocky, consolidated parent materials are also inferior for plant growth (16, 20).

The major objective of this study was to identify overburden materials that can be used to an advantage in constructing post-mining soils. The pH and nutrient content of the selected materials varied, and several fertility treatments were included to assess the importance of these chemical differences. Mixtures or blends of subsoil and overburden were also evaluated.

METHODS AND MATERIALS

Four bulk samples of soil material were taken from an abandoned highwall located on Captain Mine property in southwestern Perry County near Culter, Ill. One sample was taken from each of the Ap (topsoil), claypan B_t, lower B_3 and upper C_1 and IIIC (Illinoian glacial till) horizons (Fig. 1). The B_3 and C_1 materials were combined into one bulk sample because both were thin layers and similar in character. This mixture is referred to simply as C_1-material throughout this paper. It consists of lower Wisconsin loess, some reworked with material from the Sangamon Paleosol A horizon at the surface of the Illinoian glacial till. Depths used for collecting the bulk samples are given in Table 1 along with some important soil properties. *

The materials were spread and dried until they could be hand-worked through a 5-mm (4-mesh) screen. Plastic bags were used to line storage containers to prevent moisture fluctuation after sieving.

An initial greenhouse experiment was designed to compare the topsoil and subsoil (B_t) with the underlying C_1-materials and glacial till. The relative abundances of these materials are shown in Fig. 1. In addition to these four overburden materials, this experiment had four levels of fertility: untreated control, nitrogen (N), nitrogen and lime (NL), and nitrogen, lime, phosphorus, and potassium (NLPK). The subsurface materials were expected to be deficient in N, while the acid B_t-horizon required lime. Phosphorus and potassium were added to determine how the wide range in pH (Table 1) influenced their availability.

Analytical-grade ammonium nitrate and monobasic potassium phosphate were used to supply N, P, and K at rates of 40, 20, and 25 ppm, respectively. A 54/46 mixture by weight of calcium and magnesium carbonates was added at a rate of 1.42 g per pot containing 500 g of dry soil material. Each soil and fertility treatment was replicated using standard 4-in clay pots to create eight randomized complete blocks.

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[1] Contribution of the Agronomy Dep., University of Illinois, Champaign-Urbana, IL 61801. Received 6 Sept. 1980.

[2] Research Associate and Associate Professor of Agronomy, respectively.

Table 1—Selected physical and chemical properties of unconsolidated materials from a highwall in Perry County with a Weir soil surface.

Horizon	Depth	pH	Total-N	Sand	Silt	Clay	Exchangeable cations§ Ca	Mg	K	Phosphorus† P_1	P_2
	m		%				meq/100 g			ppm	
					Silt loam						
Ap	0-0.2	5.7	0.092	6.6	76.6	16.8	5.84	1.23	0.20	10	14
					Silty clay loam						
B_2	0.6-1.0	4.7	0.021	3.5	64.1	32.4‡	5.01	4.38	0.36	8	15
					Silt loam						
B_3-C_1	1.0-2.2	6.2	0.018	16.0	59.7	24.3	7.44	6.58	0.31	6	18
					Clay loam						
C_1	4.7-5.4	7.5	0.019	27.0	45.0	28.0	9.83	6.99	0.28	4	31

† Available phosphorus extracted using the Bray P_1 and P_2 methods.

‡ Clay content of the B_2 horizon is lower than typical for Weir soils.

§ Exchangeable cations extracted with neutral 1*N* ammonium acetate.

Similar methods were used to concurrently run a second experiment designed to compare various mixtures of B_2 and the underlying C_1-material. However, this second experiment had only one fertility treatment: N. In these first two experiments, the cropping sequence was perennial ryegrass (*Lolium perenne* L.) followed by 'Redland' red clover (*Trifolium pratense* L.) and 'Trudan-2' sudangrass (*Sorghum sudanensis* (Piper) Stapf.). After emergence, the ryegrass, clover, and sudangrass populations were thinned to 10, four, and three plants per pot, respectively. Nitrogen was added before the grasses were grown, while red clover was inoculated with *Rhizobium*. In the first experiment, an additional 1.90 g of lime/pot was applied to the B_2 treatments previously treated with NL or NLPK to obtain a pH of 6.3 before planting red clover. An application of potassium phosphate was made before planting the last crop, sudangrass, to supply 13 and 17 ppm of P and K, respectively.

All overburden mixtures were supplied with either ammonium nitrate or *Rhizobium* inoculum in the second experiment. Phosphorus and potassium were not added to these mixtures. Follow-up factorial experiments having lime, P, and soil mixtures as variables were initiated in response to the results from the first two experiments. These latter experiments were designed to assess the importance of soil pH and P availability in subsoil-substrata blending. Randomized complete block designs were used, with each treatment replicated five times, and with sudangrass as the test crop. Ammonium nitrate and potassium sulfate were used to supply all treatments with N and K at rates of 40 and 25 ppm, respectively. The lime rate was empirically adjusted to elevate pH of subsoil and all mixtures to 6.4, which was the pH of the C_1-materials. Monobasic calcium phosphate supplied P at a rate of 40 ppm.

Dry weights for herbage yields were determined after clipping ryegrass, clover, and sudangrass at ground level after 59, 83, and 90 days, respectively. Roots were recovered by hand-crushing and sieving the soil materials simultaneously through three 5-mm (4-mesh sieves. Roots and shoot weights were determined after 5 days of drying in a forced-air oven at 68°C. In experiment 4, root volume was measured using the method and apparatus described by Pinkas et al. (13).

RESULTS AND DISCUSSION

Experiment 1

Relative growth of the three test crops on the varying materials at four levels of fertility are shown in Fig. 2. Results were as expected, with topsoil supporting the highest yield levels and claypan subsoil usually supporting the lowest. The different nutritional requirements of the test crops must be considered when evaluating overburden materials. Perennial ryegrass and red clover will grow on infertile soils and are tolerant of the Al and/or Mn toxicities (4) that are likely to occur on the very strongly acid (pH 4.7) B_2 horizon. Sudangrass is

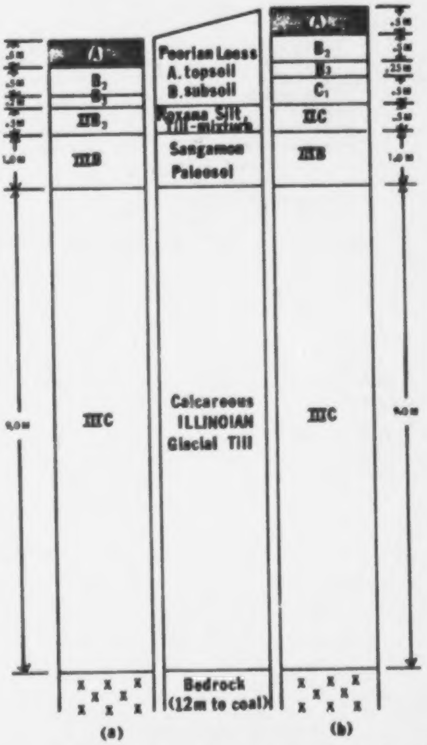

Fig. 1—Idealized mining highwall profiles contrasting soil surfaces of the (*a*) Ava-Bluford-Wynoose and Hoyleton-Cisne-Huey Associations formed on shallow loess, with those of the (*b*) Hosmer-Stoy-Weir and Oconee-Cowden-Piasa Association formed on a deeper loess (C_1) material. Glacial till (IIIC) depth has a maximum of 15 meters (M) where the bedrock is thinner.

Table 2—Relative dry weight yields† for three test crops grown in varying ratios of subsoil and underlying C_1-material (B_2/C_1).

	100:0		75:25		50:50		25:75		0:100	
	Shoots	Roots	Shoots	Roots	Shoots	Roots	Shoots	Roots	Shoots	Roots
	%									
Perennial ryegrass	23 a	19 a	35 a	24 a	50 b	38 b	63 b	50 c	61 b	33 b
Red clover	8 a	11 a	12 a	13 a	17 ab	18 a	42 c	36 b	24 b	15 a
Sudangrass	6 a	9 a	10 a	8 a	23 b	21 b	41 c	35 c	37 c	26 bc

† Shoot and root weights are expressed as percentages of those observed on fully amended topsoil. Values for a given test crop *not* followed by a similar letter are significantly different at the $P = 0.95$ level, and are the averages of eight replicate observations. The grass test crops received N at a rate of 40 ppm, while red clover was inoculated with N-fixing *Rhizobium*.

tolerant of alkaline soil conditions (4), and grows well on Illinoian glacial till at pH 8.1.

A comparison of perennial ryegrass yields at the four levels of fertility (Fig. 2) indicates that ryegrass utilized P and/or K in the deeper C_1 and glacial till materials, because maximum yields were achieved without the addition of potassium phosphate. It has been demonstrated that these deeper materials will release large amounts of soluble K when brought to the surface and allowed to dry (W. R. Craig, 1967. The amounts of available K to a dep . of four feet in four soil types and its effect on corn yield. M.S. Thesis. University of Illinois, Urbana). The P in these deeper C_1 and IIIC materials is believed to be in sparingly soluble calcium phosphate forms (3), and the relative amounts of these reserve P forms can be estimated from Table 1 by calculating the difference between the Bray P_1 and P_2 values (2).

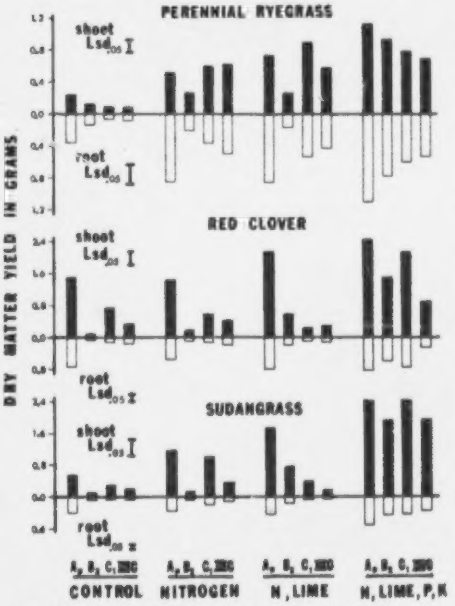

Fig. 2—Dry matter production for a sequence of three test crops grown on selected Weir topsoil (Ap) and subsoil (B_2), and on C_1-material (C_1) and Illinoian glacial till (IIIC) overburden with various amendments. Values are means of eight replications.

The significant yield response of red clover and sudangrass to lime on the B_2 material is believed to be largely due to a suppression of available Al. The very strongly acid reaction (pH 4.7) is conducive to Al toxicity (8). Manganese toxicity is also a possibility in these soils (18), and might help explain increases in the shoot/root ratios of red clover and sudangrass on the B_2 material with application of lime (shoot/root ratio data not shown).

The initial lime rate used in the experiment was 1.42 g/pot and was based upon the amount of lime required to increase the pH of the topsoil from 5.5 to 6.3, after assuming an effective neutralizing value of 100% (9). This lime rate brought the pH of the more acid subsoil to 5.2, which did not significantly alter perennial ryegrass growth. An additional lime rate of 1.9 g/pot was supplied to the claypan material to obtain a pH of 6.3, which was suitable for the successful inoculation of red clover by *Rhizobium*. After this final liming, pH levels of 7.5, 6.3, 8.0, and 8.1 were measured on the limed topsoil, subsoil, C_1-material and glacial till, respectively.

Liming was expected to enhance productivity on the acid solum materials, while decreasing productivity on the alkaline IIIC material. Red clover and sudangrass responded positively to lime on the solum materials, and ryegrass showed a positive response on the topsoil. The only yield reduction that resulted from liming was with sudangrass on C_1-material. In contrast perennial ryegrass yields were significantly increased when this C_1-material was limed.

A most spectacular response resulted from the addition of monobasic potassium phosphate to the subsurface overburden materials: plants grown in topsoil showed a less positive response to P and K addition. The highly significant response of all test crops in the B_2 material to the addition of potassium phosphate reiterates the well-known fact that these claypan subsoils of southern Illinois are infertile (7).

The positive response of test crops on the deeper C_1 and IIIC materials to potassium phosphate varied. Unlike ryegrass, red clover and sudangrass were incapable of utilizing the inherent P and/or K in the C_1-material and glacial till. As a result, these latter crops showed a highly significant yield response when treated with potassium phosphate. Sudangrass was the only test crop

Table 3—Dry matter production of sudangrass† on subsoil and underlying C_1-material with and without P.

Amendment	Subsoil		Subsoil with lime		C_1-material	
	Shoots	Roots	Shoots	Roots	Shoots	Roots
	%					
NK	8 a	12 a	8 a	8 a	18 b	41 b
NPK	23 b	32 b	47 d	70 c	36 c	63 c

† Yield expressed as percentage of that observed for fully amended topsoil (NLPK). Shoots and roots are compared separately. Those values *not* followed by a similar letter are significantly different at the $P = 0.95$ level, and are the averages of four replicate observations.

that produced yields on calcareous glacial till at pH 8.1 that were comparable to yields on topsoil with full treatment.

The C_1 material with a pH of 6.2 proved to be a very favorable plant-growing medium. Ryegrass yields on NL-treated C_1-material were equal to those on fully amended (NLPK) subsoil, and second in magnitude only to fully amended topsoil. With full amendment, the C_1-material supported red clover and sudangrass yields equivalent to those in topsoil. (This C_1-material was a mixture of the B_3 and C_1 strata, as explained in the methods and materials section.)

Experiment 2

A second experiment was designed to determine if the claypan subsoil could be enhanced as a plant-growth medium by amending it with the underlying C_1-material. Before planting the grasses N was added at a rate of 40 ppm to obtain a reasonable yield level, and red clover was inoculated with the appropriate strain of *Rhizobium*. Results are given in Table 2. As previously observed, the C_1-material consistently supported significantly higher levels of crop productivity than the subsoil did.

The herbage yields of red clover and sudangrass were significantly higher on the 25:75 mixture of B_2 to C_1-material than on either of the materials alone. This synergistic response was most strongly expressed by the relative root growth of red clover and sudangrass. Roots are very sensitive to Al in the soil solution, and Al toxicity commonly retards root proliferation in acid subsoils (5, 8, 12). Mixtures containing 0, 25, 50, 75, and 100% of the C_1-material had pH levels of 4.5, 4.6, 4.7, 5.9, and 6.4, respectively, at the end of the experiment. A soil of pH 5.9 is acid enough to increase the solubility of P in the C_1-material, and alkaline enough to eliminate any Al and/or Mn toxicities from the B_2 (8). Perennial ryegrass, which is more tolerant of soil acidity than either red clover or sudangrass, again showed the best growth on the acid mixtures.

Experiments 3 and 4

Plants grown on the unamended subsurface materials showed the reddish foliage commonly associated with P deficiency. A third experiment was initiated to determine more precisely the combination of lime and fertilizer required to eliminate differences between the subsoil and C_1-materials. Results presented in Table 3 show that sudangrass yields were significantly increased when the B_2 horizon and underlying C_1-materials were amended with P in addition to N and K. The fourth and last experiment was designed to determine if lime and P amendments could alter the synergistic interaction previously observed for mixtures of the subsurface soil and underlying C_1-material. Since maximum yields were not achieved in experiment 2 until the mixture was 75% C_1-material, somewhat higher amounts of this leached loess material were used for this experiment (Table 4).

Sudangrass shoots and roots generally responded in a similar, positive manner to the amendments, and plant growth was significantly increased by adding P, lime, and C_1-material to the B_2-horizon material. A highly significant interaction between lime and P was observed, and liming did not significantly increase herbage growth unless P was applied as well.

Roots were more sensitive than shoots to differences in the soil mixtures, and highly significant second- and third-order interactions between fertilizer and mixture treatments were observed. Phosphorus had the greatest effect on both herbage and root weight. Liming en-

Table 4—Relative dry weight yields† and root volumes‡ for sudangrass grown on varying ratios of subsoil and C_1-material (B_2/C_1) with and without lime (L) and/or phosphorus (P).

Treatments	100:0		50:50		30:70		10:90		0:100	
	Shoot yields§									
	%									
Control	8 a		19 b		22 b		22 b		18 b	
L	8 a		16 ab		18 b		21 b		–	
P	24 b		43 cd		37 c		38 c		36 c	
PL	46 cd		51 d		50 d		38 c		–	
	Root yields (%) and volume (10^{-1} cm^3/pot)§									
	Yield	Vol	Yield	Vol	Yield	Vol	Yield	Vol	Yield	Vol
Control	12 a	6 a	20 ab	9 ab	37 cd	15 bc	25 b	7 ab	41 d	22 c
L	8 a	4 a	19 ab	8 ab	27 bc	11 ab	40 d	22 ab	–	–
P	32 a	12 a	40 ab	20 abc	52 cd	26 bcd	60 de	28 cd	74 e	18 ab
PL	70 e	29 d	51 bcd	24 bcd	46 bc	31 d	56 cd	22 bcd	–	–

† Dry weight values expressed as percentages of those observed on fully amended (NPKL) topsoil. Those treated with the same P level and *not* followed by a similar letter are significantly different at the $P = 0.95$ level.

‡ Root volumes expressed as 10ths of cm^3 per pot; and values with the same P level, *not* followed by a similar letter are significantly different at the $P = 0.95$ level.

§ All values are averages of five replicate observations.

hanced the response to P by roots and shoots on the B_2-material, but crop response to P was reduced by liming when increasing amounts of C_1-material were added to this acid claypan material.

The pH levels were 4.6, 5.0, 5.3, 5.6, and 6.5 at the end of the experiment for mixtures containing 0, 50, 70, 90, and 100% C_1-material, respectively. In the lime treatments, decreasing amounts were applied in an attempt to equalize soil pH, but average pH levels of 7.1, 7.4, 7.2, 6.8, and 6.5 were measured at the end of the experiment for soil mixtures containing increasing amounts of C_1-material. Phosphorus addition tended to lower the pH by 0.1 or 0.2 units.

Subsurface materials were deficient in P. This deficiency was not simply induced by Al toxicity at the low pH of the subsoil, because sudangrass showed a significant response to P before and after liming. Normal rooting was clearly restricted in this acid subsoil, and maximum plant growth was not obtained until the B_2 was limed. Phosphorus addition consistently doubled the herbage yields of sudangrass on the various mixtures of subsoil and C_1-material, but yields were tripled on the B_2-material.

SUMMARY AND CONCLUSIONS

The native topsoil and subsoil horizons from a Weir silt loam (Typic Ochraqualf) soil were compared to deeper unconsolidated overburden strata by growing test crops directly in the materials in the greenhouse. Highly significant differences in test crop yields were observed, especially with N and lime amendments. Topsoil produced the highest plant yields, but differences among the solum and overburden materials were greatly reduced with standard additions of lime, N, P, and K. The unusually poor growth of crops on the very strongly acid subsoil (pH 4.7) indicates that it would be advantageous to alter or replace this inferior material. Results from these experiments show that the deeper C_1-materials are superior to the native subsoil and should be considered as alternatives. A significant increase in crop production in response to blending of this deeper C_1-material with the B_2 horizon was demonstrated. A similar blending could conceivably be accomplished in many mining operations with little or no additional reclamation cost. Chemical and physical analyses also suggest that careful blending would produce a more favorable texture, and increase available soil P (17).

Evidence presented indicates that replacement or alteration of the claypan subsoils of southern Illinois would increase crop growth by enhancing the chemical and physical properties of reclaimed land. Field experiments are needed to further evaluate physical factors, especially studies that compare alternative subsoil strategies with topsoil replacement. The high response of all solum and deeper strata from southern Illinois to amendment reiterates the importance of a soil-testing program for reclaimed land, followed by good fertility management.

ACKNOWLEDGMENTS

This research was supported by a grant from the U.S. Environmental Protection Agency in cooperation with the Cooperative States Research Service, with additional funding from a consortium of coal mining companies: Amax Coal Co., Consolidation Coal Co., Peabody Coal Co., Robertson and Associates, and Southwestern Illinois Coal Company.

The authors are indebted to Joe B. Fehrenbacher, Professor of Pedology, and L. Touby Kurtz, Professor of Soil Fertility, for their comments and suggestions.

The *Rhizobium* inoculum used with red clover was graciously supplied by the Urbana Laboratories, Triumph Street, Urbana, Ill.

LITERATURE CITED

1. Alway, F. T., G. R. McDole, and C. O. Rost. 1917. The loess soils of the Nebraska portion of the transition region: VI. The relative "rawness" of the subsoil. Soil Sci. 3:9–36.
2. Bray, R. H., and L. T. Kurtz. 1945. Determination of total organic and available forms of phosphorus in soils. Soil Sci. 59: 39–45.
3. Change, S. C., and M. L. Jackson. 1958. Soil phosphorus fractions in some representative soils. J. Soil Sci. 9:109–119.
4. Duke, J. A. 1978. The quest for tolerant germplasm. p. 41–59. *In* G. A. Jung (ed.) Crop tolerance to suboptimal land conditions. ASA Spec. Pub. no. 32, Am. Soc. of Agron., Madison, Wis.
5. Estrada, J., and G. A. Cummings. 1968. Effects of lime and phosphorus treatments in specific horizons of acid soil on growth and chemical composition of corn (*Zea mays* L.). Agron. J. 60: 447–450.
6. Fehrenbacher, J. B., and J. H. Snider. 1954. Corn root penetration in Muscatine, Elliott and Cisne soils. Soil Sci. 77:281–291.
7. Fehrenbacher, J. B., G. O. Walker, and H. L. Wascher. 1967. Soils of Illinois. Illinois Agric. Exp. Stn. Bull. 725.
8. Foy, C. D. 1975. Effects of aluminum on plant growth, Part III. p. 612–632. *In* E. W. Carson (ed.) The plant root and its environment. University Press of Virginia, Charlottesville.
9. Graffis, D. W., R. G. Hoeft, and E. L. Knake et al. 1976. Illinois agronomy handbook, 1977–1978. Illinois Agric. Exp. Stn. Circ. 1129. p. 31.
10. McGinnies, W. J., and J. R. Ludwig. 1977. Effects of Natrustoll (Solonetz) soil horizons and nitrogen on growth of tall wheatgrass. Agron. J. 69:518–520.
11. Olson, T. C. 1977. Restoring the productivity of a glacial till soil after topsoil removal. J. Soil Water Conserv. 32:130–132.
12. Phillips, J. A., and E. J. Kamprath. 1973. Soil fertility problems associated with land forming in the Coastal Plain. J. Soil and Water Conserv. 28:69–73.
13. Pinkas, L. L. H., M. R. Teel, and D. Swartzendruber. 1965. A method for measuring the volume of small root systems. Agron. J. 56:90–91.
14. Rost, C. O. 1939. The relative productivity of some humid subsoils. Soil Sci. Soc. Am. Proc. 4:281–287.
15. Smeck, N. E., and E. C. A. Runge. 1971. Phosphorus availability and redistribution in relation to profile development in an Illinois landscape segment. Soil Sci. Soc. Am. Proc. 30:624–630.
16. Smith, R. M., and G. G. Pohlman. 1951. Comparison of subsoils and surface soils in the greenhouse as an aid in understanding and reclaiming eroded soils. Agron. J. 43:259–264.
17. Snarski, R. R., J. B. Fehrenbacher, and I. J. Jansen. 1981. Physical and chemical characteristics of pre-mine soils and post-mine soil mixtures in Illinois. Soil Sci. Soc. Am. J. 45(4) (in press).
18. Snider, H. J. 1943. Manganese in some Illinois soils and crops. Soil Sci. 56:187–195.
19. United States. 1979. Surface Mining Control and Reclamation Act of 1977, Section 515:6–7. United States Statutes at Large 91: 487–488. U.S. Government Printing Office, Washington, D.C.
20. Winters, E., and R. W. Simonson. 1951. The subsoil. Adv. Agron. 3:1–93.

Reprinted from the *Soil Science Society of America Journal*
Volume 45, no. 4, July-August 1981
677 South Segoe Rd., Madison, WI 53711 USA

Physical and Chemical Characteristics of Pre-mine Soils and Post-mine Soil Mixtures in Illinois[1]

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ABSTRACT

The chemical, physical, and mineralogical properties of Sable and Darmstadt soils were studied to determine the value of solum and subsolum material as mediums for plant growth. Sable silty clay loam from western Illinois has nearly ideal physical and chemical properties for plant growth, while the more weathered Darmstadt silt loam from southern Illinois has unfavorable chemical and physical properties that limit plant growth.

The suitability of various soils and subsurface overburden mixtures were determined by measuring and defining the chemical and physical properties that have a potential for enhancing or limiting plant growth. The B2 horizon material from the Darmstadt soil has the least favorable properties. The top 3-m mix (topsoil included) and 3-m mix (topsoil not included) have similar properties and appear to be the most favorable materials for use in constructing a post-mine soil. The range of chemical and physical properties in the Sable mixtures are not as great as in the Darmstadt mixtures. The top 3-m mix, 6-m mix (exclusive of the A horizon), and calcareous loess mix from the Sable soil all have similar chemical and physical properties.

Incorporation of the A horizon into the 3 m below the A horizon of both Sable and Darmstadt soils only slightly enhances the chemical and physical properties of the mixtures.

Comparison of tested and calculated soil values indicate that most chemical and textural properties of a solum and subsolum mixture can be predicted prior to mining. The pH of a mixture can also be predicted by using an equilibration technique.

Additional Index Words: soil mixing, disturbed soils, surface mine reclamation.

Snarksi, R. R., J. B. Fehrenbacher, and I. J. Jansen. 1981. Physical and chemical characteristics of pre-mine and post-mine soil mixtures in Illinois. Soil Sci. Soc. Am. J. 45:806–812.

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[1] Contribution from the Dep. of Agron., Univ. of Ill., U-C Campus, Urbana. Part of a thesis submitted by the Senior Author in partial fulfillment of the requirements of the M.S. Degree at the Univ. of Ill. Received 29 Sept. 1980. Approved 19 Feb. 1981.

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THE OBJECTIVES in reclamation of prime farmland after surface mining, as defined in the Federal Surface Mining Control and Reclamation Act of 1977,[8] is to construct soils on the post-mine landscape that are at least as productive as those that existed before mining. A crucial step in the soil construction effort is selecting the best material for use in building each layer of the new soil. Most mine sites in Illinois have a variety of materials available from the overburden and from the pre-mine soils. There are indications that materials other than those from the solum of pre-mine soils should be considered at some sites.

In greenhouse experiments (Dancer and Jansen, 1981) using various soil horizons from Weir silt loam (a fine, montmorillonitic, mesic Typic Ochraqualf) from southern Illinois, soybeans and forage crops grew best on the topsoil (A horizon). Leached loess material from below the B2 horizon was superior to the acid, claypan subsoil (B2) as a medium for plant growth. Perennial ryegrass and red clover grew best where leached loess dominated the mixture, and as more B2 horizon was included, yields decreased. Studies with Darmstadt silt loam (a fine, montmorillonitic, mesic Albic Natraqualf) showed soybean growth was enhanced by blending the B2 horizon with underlying loess material (W. S. Dancer and K. McSweeney, 1980, personal communication).

In New Mexico, plant establishment and growth was best when 4 inches (10.2 cm) of surface soil was mixed into the spoil and an additional 8 inches (20.3 cm) of soil was applied over the top (Aldon, 1978). Only 2 inches (5.1 cm) of topsoil over sodic spoil in the northern Great Plains increased crop growth and water infiltration when compared to bare spoils (Sandoval et al., 1973). Using a Williams silt loam (a mixed Typic Argiboroll) in North Dakota, crop growth increased as total thickness of replaced topsoil and subsoil over sodic spoils was increased to 28 inches (71 cm). Replacement of topsoil and subsoil in separate layers was superior to mixing the two materials (Power et al., 1978).

Due to the lack of definitive information concerning the potential of unconsolidated overburden to support crop growth in mining regions of Illinois, this study was undertaken to (i) analyze the chemical, physical, and mineralogical properties of two complete soil profiles representative of Mollisols and Alfisols in mining areas of Illinois; (ii) evaluate the suitability of various soil and subsurface overburden mixtures by measuring and defining the chemical and physical properties that have a potential for enhancing or limiting plant growth; and (iii) determine if the chemical and physical properties of a mixture of solum and subsolum layers can be predicted by analyses of the individual layers prior to mixing.

MATERIALS AND METHODS

Soil and Greenhouse Sampling

Two commonly occuring soils found in surface mining regions of Illinois were sampled—Sable silty clay loam (Typic Haplaquolls, fine-silty, mixed, mesic) from Mecco Mine, Knox County (western Illinois), and Darmstadt silt loam (Albic Natraqualfs, fine, montmorillonitic, mesic) from Captain Mine, Perry County (southern Illinois). The soils were sampled from exposed highwalls.

In a companion investigation, large quantities of selected materials from the same two soils and underlying geologic materials were collected for a study in which soybeans were grown in various soil mixtures in polyethylene cylinders (15-cm diam, 90-cm long) under greenhouse conditions (McSweeney et al., 1981). Prior to mixing, the soils were sieved through a 1.9-cm screen. Six different blends were designed for each soil. In five of the mixtures, the darkened surface soil (A horizon) was placed on top of the subsurface mix before the start of the experiment (Table 1). It is important to distinguish between the top 3-m mix, where the A horizon was incorporated into the mix, and the 3-m mix, where the A horizon was not incorporated. Once the soybeans were grown and harvested, a representative soil sample was taken from each of the 12 mixtures for laboratory analysis.

Laboratory Analysis

Particle size distribution of the natural soil horizons and soil mixtures was determined by the pipette method (Kilmer and Alexander, 1949), modified by using sodium hexametaphosphate for the dispersing agent, and a 7.5% H_2O_2 treatment was used to destroy organic matter. Cation exchange capacity (CEC) was determined by the procedure of Peech et al. (1947). Exchangeable bases (Ca, Mg, K, and Na) were extracted by the automatic extraction procedure of Holmgren et al. (1977). Exchangeable Na and K were measured with a flame photometer. Exchangeable Ca and Mg were analyzed by atomic absorption. The pH of a 1 to 1 soil:water suspension was measured with a pH meter. Organic C was determined by the Walkley-Black method (Allison, 1965). Readily available and reserve P were measured by the Bray-1 and Bray-2 methods, respectively (Laverty, 1962). Available P was also determined by the Olsen method, using the sodium bicarbonate procedure

Table 1—Profile horizon designation with depth for Sable and Darmstadt soils illustrating the various materials included in the six soil mixtures of each soil.

	Material	Horizon	Depth (cm)	
	Sable series			
	Topsoil	Ap	0–31	Top 3-m Mix
	Topsoil	A3	31–43	
B2 mix 6-m mix	Subsoil	B21	43–71	Total B mix 3-m mix
	Subsoil	B22	71–86	
	Subsoil	B23	86–107	
	Subsoil	B3	107–140	
C-loess mix	Calc. Peoria loess	C1	140–274	
	Calc. Basal Peoria	C2	274–338	
	Roxana loess	IIC3	338–404	
	Rox. & Sang. mixed	IIC4	404–445	
	Sangamon soil	IIIAb	445–483	
	Sangamon soil	IIIB21bt	483–544	
	Sangamon soil	IIIB22b	544–594	
	Calc. Illinoian till	IIIC	594–633	
	Darmstadt series			
	Topsoil	Ap	0–23	Top 3-m mix
	Topsoil	A2	23–36	
B2 mix 6-m mix	Subsoil	B21t	36–66	3-m mix
	Subsoil	B22t	66–94	
	Subsoil	B23t	94–119	
	Subsoil	B31t	119–156	
	Leached Roxana loess	IIB32	156–203	
	Rox. & Sang. mixed	IIB33	203–262	
	Sangamon soil	IIIAb	262–296	
Bottom 3-m mix	Sangamon soil	IIIB21b	296–388	Sangamon B mix
	Sangamon soil	IIIB22b	388–467	
	Sangamon soil	IIIB3b	467–544	
	Calc. Illinoian till	IIIC1	544–580	
	Calc. Illinoian till	IIIC2	580–605 +	

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[8] United States. 1979. Surface mining control and reclamation act of 1977. United States Statutes at Large 91:487–488. U. S. Government Printing Office, Washington, DC.

outlined by Knudson (1975). Calcium carbonate equivalent was determined by the gravimetric loss of CO_2 described by the U. S. Salinity Laboratory staff (1954). Base saturation was calculated by dividing the sum of exchangeable bases (Ca, Mg, K, and Na) by the CEC.

Mineralogy of clay was determined by x-ray diffraction using copper-Kα radiation. The method described by Kinter and Diamond (1956) was used for slide preparation. Expandable clays were identified by a first-order reflection of 17.8A on glycerol-solvated samples, and illite was identified by the 10.0A peak on Mg-saturated samples. Kaolinite and chlorite were identified by the 001 peak of kaolinite and 002 peak of chlorite at 7.15A. Peak intensities were corrected using the factors 1, 3, 2 for expandables; illite and kaolinite-chlorite, respectively, to determine the relative percentage of each present in the samples.

RESULTS AND DISCUSSION

Sable silty clay loam is a poorly drained soil formed in thick Peoria loess. It is one of the most productive soils in Illinois, where its poor natural drainage has been corrected by tile. The A and B2 horizons are silty clay loam in texture and have very good physical and chemical properties for growth of crops such as *Zea mays* and *Glycene max* (Tables 2 and 3). Calcareous Peoria loess (C1 and C2) occurs between 140 and 338 cm in depth. Calcareous Roxana loess (IIC3) occurs between 338 and 404 cm in depth. The Roxana and Sangamon mixed zone (IIC4) is a mixture of Roxana loess and the A horizon of the Sangamon paleosol. The Sangamon paleosol (IIIA and IIIB) is a buried soil formed in Illinoian glacial till. The upper B of the paleosol qualifies as an argillic horizon. Only 39 cm of calcareous glacial till (IIIC) occurs between the Sangamon solum and bedrock. However, thicker deposits of calcareous till commonly occur just above bedrock in western Illinois.

Darmstadt silt loam is a somewhat poorly drained soil formed in Peoria and Roxana loesses. This soil is more highly weathered and has more distinct horizons than Sable. It also has unfavorable physical and chemical properties that limit plant growth; a high clay content (claypan) in the B2 horizon, a very strongly acid upper B, and a high Na content (natric horizon) in the mid- and lower B horizons. Clays in the mid- and lower B horizons are mostly dispersed, causing poor aeration and low permeability. The Roxana loess and a mixed zone of Roxana and Sangamon soil (IIB3) extend down to the Sangamon paleosol (IIIA and IIIB) and show only weak evidence of soil formation (i.e., loss of carbonates and weak structure development). The Sangamon paleosols formed in Illinoian glacial till are calcareous below 544 cm.

Clay Mineralogy

Clay minerals were grouped into the three major clay types (expandable clay, illite, and kaolinite-chlorite). The expandable clay fraction is mainly montmorillonite with some vermiculite. Kaolinite and chlorite were not differentiated from each other because of the very small amount of chlorite present in the profiles.

Illite is the dominant clay mineral in the A horizon of Sable soil (Table 3). In and below the solum, expandable clays remain the dominant clay mineral through the calcareous loess down to the Roxana and

Table 2—Chemical properties of Sable and Darmstadt soils.

Horizon	Depth	pH 1:1	Organic carbon	$CaCO_3$ equiv.	Exchangeable bases Ca	Mg	K	Na	CEC	Base sat.	Exch. Na	Bray† P_1	Bray† P_2	Olsen† P	K†‡
	cm		—— % ——		—— meq/100 g ——					—— % ——		—— kg/ha ——			
				Sable silty clay loam (Typic Haplaquoll, fine-silty, mixed, mesic)											
Ap	0–31	5.5	2.82	0	16.90	5.94	0.29	0.12	27.22	85.0	0.4	41	84	21	253
A3	31–43	5.5	1.93	0	17.19	6.09	0.27	0.13	25.6	92.5	0.5	9	9	7	236
B21	43–71	5.5	0.77	0	17.03	7.03	0.48	0.17	26.1	94.7	0.7	10	15	6	419
B22	71–86	6.0	0.33	0	13.99	7.12	0.35	0.19	23.0	94.1	0.8	36	76	22	306
B23	86–107	6.7	0.26	0.5	14.28	6.76	0.33	0.24	19.7	100+	1.2	10	81	5	288
B3	107–140	7.5	0.13	0.9	12.33	7.26	0.26	0.16	14.8	100+	1.1	7	172	12	227
C1	140–274	8.0	0.09	13.8	12.82	6.93	0.21	0.16	11.3	100+	1.4	4	165	4	184
C2	274–338	8.0	0.13	15.2	12.49	7.13	0.19	0.16	10.1	100+	1.6	6	124	7	166
IIC3	338–404	7.8	0.13	1.1	11.12	6.77	0.11	0.15	11.8	100+	1.3	15	178	11	96
IIC4	404–445	7.6	0.09	0.1	9.13	5.65	0.15	0.15	10.2	100+	1.5	4	11	10	131
IIIAb	445–483	7.5	0.08	0	10.42	6.06	0.09	0.11	11.4	100+	1.0	2	6	8	78
IIIB21bt	483–544	7.4	0.07	0.8	15.80	6.84	0.22	0.16	17.9	100+	1.0	2	3	10	193
IIIB22b	544–594	7.5	0.07	0.2	14.58	6.80	0.24	0.20	14.3	100+	1.4	2	141	11	209
IIIC	594–633	8.1	0.04	8.2	28.07	3.56	0.20	0.16	9.8	100+	1.8	1	148	4	175
				Darmstadt silt loam (Albic Natraqualf, fine, montmorillonitic, mesic)											
Ap	0–23	6.2	0.74	0.0	7.20	1.06	0.16	0.30	8.06	100	3.5	15	40	9	140
A2	23–36	5.0	0.42	0.0	3.56	0.93	0.12	0.26	9.24	52.7	2.8	4	7	6	105
B21t	36–66	4.9	0.49	0.0	9.20	5.41	0.22	2.56	23.67	77.6	12.2	2	7	3	193
B22t	66–94	6.9	0.16	0.0	13.14	6.86	0.18	5.71	23.41	100+	24.4	29	77	32	157
B23t	94–120	7.9	0.08	0.3	11.99	6.61	0.15	5.65	21.73	100+	26.0	48	159	63	131
B31t	120–166	8.3	0.09	0.4	13.34	6.44	0.15	4.39	17.36	100+	25.3	61	184	37	131
IIB32	166–203	8.2	0.08	0.3	13.32	6.43	0.10	3.15	13.76	100+	22.9	64	184	39	87
IIB33	203–262	8.2	0.08	0.3	12.88	6.33	0.13	1.83	14.06	100+	12.3	63	148	36	113
IIIAb	262–296	7.4	0.06	0.1	11.24	7.08	0.23	1.13	17.43	100+	6.5	35	97	23	200
IIIB21b	296–386	7.7	0.06	0	13.30	7.08	0.11	0.80	17.88	100+	4.5	7	30	13	96
IIIB22b	386–467	8.0	0.03	0	12.62	6.70	0.13	0.70	14.61	100+	4.8	3	16	6	113
IIIB3b	467–544	8.1	0.02	0.5	10.56	5.96	0.20	0.52	11.67	100+	4.5	3	148	7	175
IIIC1	544–559	8.4	0.04	8.0	30.80	6.86	0.22	0.32	10.29	100+	3.1	3	141	21	193
IIIC2	559–605+	8.4	0.04	9.2	30.36	6.45	0.20	0.38	9.53	100+	4.0	3	40	7	175

† Established nutrient ranges for Illinois soils. Bray P_1: Low 0–11, slight 12–22, medium 23–34, high 35+. Bray P_2: Low 0–36, slight 37–59, medium 60–84, high 85+. Olsen P: Low 0–6, medium 7–17, high 18+. Potassium: Low 0–202, slight 203–269, medium 270–336, high 337+.

‡ K meq/100 g × 874 = K kg/ha.

Sangamon mixed zone (IIC4). Here the expandable clay content begins to decrease and reaches a minimum of 5% in the Sangamon B and calcareous till. Illite is dominant in the lower Sangamon paleosol and calcareous till.

Kaolinite and chlorite are the dominant clay minerals in the A horizon of Darmstadt. The expandable clay content increases from a low of 15% in the Ap to a maximum of 50% in the lower B2 and upper B3 horizons (Table 3). Expandable clays remain the dominant clay mineral down to the Sangamon B21 and then decreases rapidly to only 10% in the calcareous till. Illite is the dominant clay material in the lower Sangamon paleosol and calcareous till.

Phosphorus

The Sable soil is highest in readily available phosphorus in the A and B22 horizons, while reserve P is highest in the B3, calcareous Peoria loess, Roxana loess, lower Sangamon B, and calcareous till. In Darmstadt, the highest levels of both readily available and reserve P were in the lower Peoria and Roxana loesses.

Two phosphorus tests were used to measure readily available P because of the wide range in pH and carbonate content of the soil materials evaluated. The Bray-P1 test correlates well with crop yield response to P on most acid and neutral soils in Illinois, but it does not work well for calcareous materials. The Olsen phosphorus test is more useful than Bray-P1 for measuring available P in calcareous soils.

The Bray-P2 test was used in this study to indicate if considerable amounts of reserve P (less soluble forms) were present. A high Bray-P2 test indicates that considerable amounts are present. It is not a reliable indicator of the total amount present in calcareous materials, however, because the acid extracting solution will be neutralized before all of the acid-soluble P has been extracted.

Readily available phosphorus, rather than reserve forms, are of interest for fertility management purposes. The reserve P is of interest, however, when selecting materials for soil construction. Some of that reserve will be released in the future by weathering, especially as the new soil is leached of carbonates. Carbonate leaching is a slow process, but in a Nebraska study, the carbonate content of the top 14 cm of a soil was reduced from 11 to 5%, and the pH reduced from 8.0 to 7.5, after 75 years (Andrew and Rhoades, 1947). The leaching of carbonates and subsequent release of P will be accelerated somewhat where materials high in calcium phosphates interface with masses of acid-soil material as a result of mixing during soil construction.

Mixtures from Sable and Darmstadt Profiles

Six mixtures were prepared using solum and subsolum materials from a Sable soil. Table 1 illustrates the kinds of materials composing each mixture. The chemical and physical data for these mixtures, both measured and calculated, are shown in Table 4. The silty-clay loam A horizon of the Sable soil was replaced at the surface on five of the mixtures and included in the mix for the sixth. The B2 mix has a favorable pH (6.2) and the highest available P content of the

Table 3—Physical and mineralogical properties of Sable and Darmstadt soils.

		Particle size distribution (mm)				Clay minerals (< 2 μm)		
Horizon	Depth	Coarse fragments > 2.0	Sand 2.0–0.050	Silt 0.050–0.002	Clay < 0.002	Expandable clay	Illite	Kaolinite, chlorite, or both
	cm	%						
		Sable silty clay loam (Typic Haplaquoll, fine-silty, mixed, mesic)						
Ap	0–31	<0.1	1.2	66.5	32.3	25	45	30
A3	31–43	<0.1	1.0	65.7	33.3	35	35	30
B21	43–71	<0.1	1.0	63.0	36.0	50	20	30
B22	71–96	<0.1	0.9	66.0	33.1	50	25	25
B23	96–107	<0.1	0.8	69.2	30.0	50	30	20
B3	107–140	<0.1	1.3	75.6	23.1	50	30	20
C1	140–275	<0.1	1.2	82.8	16.0	45	35	20
C2	275–338	<0.1	0.4	84.5	15.1	45	30	25
IIC3	338–404	<0.1	5.7	75.2	19.1	40	25	35
IIC4	404–445	0.4	17.6	65.2	17.2	15	30	55
IIIAb	445–483	1.4	21.6	55.5	22.9	15	30	55
IIIB21bt	483–544	1.9	28.4	36.1	35.5	5	45	50
IIIB22b	544–594	2.8	36.3	37.0	26.7	5	55	40
IIIC	594–633	3.8	33.7	44.0	22.3	5	60	35
		Darmstadt silt loam (Albic Natraqualf, fine, montmorillonitic, mesic)						
Ap	0–23	0.4	3.4	82.9	13.7	15	35	50
A2	23–36	<0.1	7.7	77.3	15.0	20	40	40
B21t	36–66	<0.1	2.0	49.0	49.0	35	35	30
B22t	66–94	<0.1	4.3	61.3	34.4	45	30	25
B23t	94–120	<0.1	4.2	63.0	32.8	50	30	20
B31t	120–155	0.1	2.6	73.0	24.4	50	30	20
IIB32	155–203	0.3	9.1	68.6	22.3	45	30	25
IIB33	203–262	0.3	13.7	62.2	24.1	40	30	30
IIIAb	262–296	0.4	14.3	58.5	27.2	45	30	25
IIIB21b	296–386	0.5	17.8	53.3	28.4	45	25	30
IIIB22b	386–467	1.0	29.1	43.8	27.1	15	45	40
IIIB3b	467–544	1.1	30.5	43.9	25.6	10	50	40
IIIC1	544–559	2.2	31.5	46.8	21.7	10	55	35
IIIC2	559–605+	2.4	31.1	48.2	20.7	10	60	30

various mixtures. The clay content is moderate (32.5%) but higher than in materials above and below the B2 horizon. The higher clay content could be disadvantageous where the soil structure is partly or completely destroyed during mining and reclamation. In the total B mix, the clay content was slightly lower than the B2 mix, due to the addition of the B3 horizon. The total B mix has a much higher pH (7.7) than the B2. A ph between 6.0 and 7.0 appears optimum for many crops since most essential nutrients are available within this range (Brady, 1974). When mixing in deeper calcareous loess below the solum or in the 3-m mix and top 3-m mix, the clay content is substantially reduced to 20%, giving the mixture a desirable silt-loam texture. However, carbonate content, as well as pH, is greatly increased. The readily available P content (Olsen-P and Bray-P1) is lower, but the reserve P content (Bray-P2) is higher in the 3-m mix and top 3-m mix as compared to the B2 and total B mixtures. The four remaining soil material mixes all have very similar chemical and physical properties. The top 3-m mix and 3-m mix both include the B horizon and calcareous Peoria loess to a depth of 3 m. They differ only in that the former has the A horizon incorporated whereas the A horizon is excluded from the latter, so that it could be replaced at the soil surface. Blending in the strongly acid A horizon reduced the pH of the moderately alkaline mixture by only 0.1-pH unit and increased the organic-C content from 0.1 to 0.4%. In general, incorporating the A horizon did not greatly enhance the properties of the mixture. Replacing the A horizon at the soil surface would make fertility management somewhat easier: the calcareous soil mixture would be covered by a layer of acid material which could easily be limed to bring it to an ideal pH range. Replacing the A horizon would also make seedbed preparation easier and promote a better environment for seedling emergence and growth. The calcareous mixture would have weak and unstable aggregates if it were exposed to the surface (Chepil and Woodruff, 1963). The advantages of replacing an A horizon will disappear as an A horizon develops on the calcareous mixture over time.

The 6-m mix involved the incorporation of the B horizon, calcareous loess, Sangamon paleosol, and calcareous till. This is essentially a mixture of the total unconsolidated portion of the overburden. The C-loess mix is one that would not likely be used in practice, but it has been included to assess its suit-

Table 4—Tested vs. calculated soil test values for Sable and Darmstadt soil mixtures.

Soil mixture	Bray P_1		Bray P_2		Olsen P		$CaCO_3$ equiv.		Organic carbon		CEC	
	Test	Calc.	Test	Calc.	Test	Calc.	Test	Calc.	Test	Calc.	Test	Calc.
	kg/ha						%				meq/100 g	
	Sable silty clay loam (Typic Haplaquoll)											
Total A	26	31	35	40	17	17	0	0	2.66	2.56	26.58	26.73
B2 mix	31	17	74	50	22	11	0	0.1	0.40	0.50	21.72	23.32
Total B mix	21	13	106	92	22	11	0.8	0.4	0.31	0.37	18.86	20.40
Top 3-m mix	11	11	150	116	15	9	7.4	8.4	0.40	0.49	14.00	15.64
3-m mix	9	8	146	128	8	8	7.8	9.7	0.11	0.19	13.15	13.96
6-m mix	7	7	112	106	13	9	6.2	5.6	0.16	0.15	12.86	13.47
C-loess mix	8	7	115	120	13	7	5.9	8.4	0.10	0.10	10.57	11.00
	Darmstadt silt loam (Albic Natraqualf)											
Total A	18	11	40	28	13	8	0	0	0.82	0.63	8.57	8.86
B2 mix	12	16	19	40	8	17	0.1	0	0.48	0.33	21.44	23.56
Top 3-m mix	37	38	137	118	27	29	0.1	0.2	0.31	0.19	16.00	16.86
3-m mix	41	41	157	130	29	32	0.1	0.1	0.19	0.13	17.43	17.61
6-m mix	13	21	103	96	11	20	1.0	0.9	0.09	0.06	15.15	15.86
Sang. B mix	5	[illegible]	67	62	10	9	0.2	0.1	0.06	0.04	14.29	14.68
Btm. 3-m mix	5	5	97	88	9	10	1.6	1.6	0.07	0.04	13.15	13.96

Soil mixture	Exchangeable cations								pH 1:1 H_2O		Particle size distribution (< 2 mm)					
	Ca		Mg		K		Na				Sand		Silt		Clay	
	Test	Calc.	Test	Calc.	Test	Calc.	Test	Calc.	Test	Soil mix	Test	Calc.	Test	Calc.	Test	Calc.
	meq/100 g										%					
	Sable silty clay loam (Typic Haplaquoll)															
Total A	17.53	17.00	6.70	5.96	0.31	0.28	0.18	0.13	5.5	5.6	6.9	1.1	58.5	66.3	34.6	32.6
B2 mix	16.27	15.42	6.83	5.97	0.27	0.40	0.13	0.20	6.2	6.3	7.7	0.9	59.8	65.7	32.5	33.4
Total B mix	16.71	14.36	6.66	7.07	0.23	0.35	0.44	0.18	7.7	7.6	1.1	1.0	69.2	69.1	29.7	29.9
Top 3-m mix	18.43	14.62	7.56	6.89	0.30	0.26	0.18	0.16	7.9	7.9	1.1	1.0	76.9	77.0	22.0	22.0
3-m mix	13.25	13.26	7.06	7.02	0.30	0.25	0.31	0.17	8.0	8.0	0.4	1.0	79.7	78.7	19.9	20.3
6-m mix	17.59	13.90	6.99	6.68	0.19	0.21	0.25	0.17	8.0	8.1	10.8	12.0	65.5	65.6	23.7	22.4
C-loess mix	12.37	11.72	7.01	6.69	0.21	0.17	0.19	0.15	8.1	8.1	6.9	6.1	76.3	76.5	16.8	17.4
	Darmstadt silt loam (Albic Natraqualf)															
Total A	6.60	5.90	1.36	1.01	0.09	0.16	0.65	0.29	6.1	5.7	3.7	4.9	83.4	80.9	12.9	14.2
B2 mix	11.03	11.10	5.61	6.10	0.32	0.20	3.43	3.80	5.2	5.5	1.6	3.1	61.4	60.1	37.0	36.8
Top 3-m mix	8.97	11.53	4.57	5.77	0.15	0.16	2.63	2.96	6.7	7.2	1.1	7.7	74.2	66.0	24.7	26.3
3-m mix	11.21	12.32	6.07	6.42	0.23	0.16	2.94	3.25	6.9	7.5	0.9	8.1	72.3	64.0	26.8	27.9
6-m mix	16.40	15.87	6.74	6.51	0.26	0.16	1.32	1.86	8.3	8.3	19.2	20.2	53.7	54.2	27.1	25.6
Sang. B mix	11.04	12.28	6.39	6.61	0.13	0.15	0.65	0.68	8.1	8.0	24.1	25.4	48.8	47.3	27.1	27.3
Btm. 3-m mix	18.96	15.56	6.61	6.55	0.29	0.16	0.66	0.62	8.3	8.3	21.7	26.6	51.7	47.2	26.6	26.2

Established nutrient ranges are shown in Table 2.

ability for supporting plant growth. The 6-m mix, C-loess mix, 3-m mix and top 3-m mixtures all have desirable silt loam textures. They have a medium available-P content (Olsen-P) and a high reserve-P content (Bray-P2). These four mixtures have a less desirable pH but a more favorable texture than the B2 and total B mixtures. The exchangeable sodium percentage is low in all the Sable mixtures and presents no problem for the plant growth.

Darmstadt Mixtures

The B2 mix possessed unfavorable chemical and physical properties that would limit plant growth (Table 4). It has 37% clay, predominantly expandable clays. The exchangeable sodium percentage is high, causing dispersed clays and the consequent reduction of permeability, aeration, and root penetration.

The A horizon has a silt loam texture with an exchangeable sodium percentage of 7.6. It contains the highest organic C content but lowest K content within the profile. Incorporation of the A horizon into the top 3 m does not greatly enhance the properties of the mixture.

The 3-m mix and top 3-m mix contain the highest P levels (Bray-P1, Olsen-P, and Bray-P2) and have the most favorable pH values of all the mixtures. By mixing the B2 horizons with the deeper leached loess (B3 horizon), the clay content has been reduced from that of the B2 to a favorable silt loam texture. Adding the leached loess also enhanced the supply of available P (Bray-P1 and Olsen-P) over that in the B2 material alone. The 3-m mixtures have high exchangeable sodium percentages (16%) as does the B2 mixture, but the effect is not as severe because of the lower clay content.

The 6-m mix is a blend incorporating the B horizon, Sangamon, paleosol, and calcareous till to a depth of 6 m. The addition of the deeper glacial till material reduces the exchangeable sodium to 8% from the 16% in the 3-m mix (Table 4). The 6-m mix has substantially less available P (Olsen-P and Bray-P1) than does the 3-m mix, but at least as much as the B2 mix. Reserve forms are substantially higher in the 6-m mix than in the B2 mix. The difference in Bray-P2 test values between the 3-m and 6-m mixes are not necessarily meaningful because of the higher carbonate levels in the 6-m mix. The higher pH in the 6-m mix should be considered a negative feature.

The bottom 3-m mix includes the Sangamon paleosol and calcareous till. The Sangamon and bottom 3-m treatments have similar properties, such as a low organic C content, medium Olsen-P, and high pH (8.1 and 8.3, respectively). The textures are favorable with 27% clay, and exchangeable sodium percentage is relatively low (5%) compared to the other mixtures. The soil mixtures, as well as the natural soil profiles of both Sable and Darmstadt, have Ca:Mg ratios above 1.0. The Sable soil profile generally has a medium K content in the solum; Darmstadt has a low K content. The Sangamon paleosol and calcareous till in Sable and Darmstadt have low K contents.

Soluble sodium was measured in the Darmstadt soil to determine if it was present as a soluble salt which would result in the exchangeable Na percentage being overestimated. It was present as a soluble salt, but the amount present was not enough to appreciably change the exchangeable Na percentage.

Predicting the Chemical and Physical Properties of Soil Mixtures

A weighted average (Table 4) of various soil properties was calculated from each of the six soil mixtures of Sable and Darmstadt soils by using the test results and thickness from the natural soil horizons (Table 1).

The pH values could not be calculated by taking the weighted average of the test values, since pH is a logarithmic function and is influenced by the effect of other factors such as $CaCO_3$, organic matter, and reserve acidity. Titration curves for each material would need to be established before pH values could be accurately calculated. The mix pH values were determined in this study by preparing a sample of each mixture in the laboratory. The mixtures were subjected to five wetting and drying cycles to allow a reasonable amount of time for the various materials in the mixtures to react. Then, pH values for each mixture were measured. The test pH values were from a similar mix of materials that had been prepared several months earlier and had grown a crop of soybeans in a greenhouse.

Calculated soil values were compared to the tested soil values for each mixture using correlation coefficients (Table 5) to provide an indication of how well chemical and physical properties of a soil mixture can be predicted prior to mixing.

Mixing of materials under field conditions is generally less complete than was accomplished in the laboratory. Predictions made from laboratory samples would be most meaningful for spoil from mining wheels, which generally have moderately sized masses of intermixed contrasting materials. Equilibration time would be longer than for the laboratory samples, but the eventual effect should be similar. Plants growing in most wheel spoils would have exposure to each of the components of the mixture through their root systems. Predictions should be made less confidently where the masses of contrasting materials are large, such as is true in most dragline or shovel spoils. In these spoils, equilibration would be much slower and the root systems of individual plants might commonly be limited to only one or two of the components of the mixture.

Table 5—Correlation coefficients comparing tested vlaues with calculated values for Darmstadt and Sable soil mixtures.

	Particle size distribution							Cation exchange capacity	Exchangeable cation				$CaCO_3$ equiv.	Organic carbon
	Sand	Silt	Clay	pH†	Bray P_1	Bray P_2	Olsen P		Ca	Mg	K	Na		
Darmstadt	0.967	0.967	0.963	0.956	0.957	0.954	0.849	0.996	0.894	0.968	0.716	0.987	0.992	0.997
Sable	0.703	0.949	0.988	0.998	0.761	0.936	0.491	0.994	0.687	0.271	0.426	0.168	0.988	0.999

* A correlation coefficient of 0.811 and above is significant at the 0.05 confidence level.

† pH was not calculated from the weighted average of the individual horizons.

Silt, clay, Bray-P2, CEC, $CaCO_3$ equivalent, and organic-C showed very high correlations between the calculated and tested values for both Sable and Darmstadt. The calculated values for exchangeable bases in Sable are close to the test values. The correlation coefficients are low only because all points cluster too closely for effective correlation analysis.

The tested pH values and pH mix values are highly correlated (Table 5) for both the Sable and Darmstadt mixtures. As previously discussed, using the equilibration technique for predicting the pH of a mixture is simple and efficient. By selectively choosing various materials in the profile, the pH of a mixture can be predicted in the laboratory with a reasonable degree of assurance.

SUMMARY AND CONCLUSIONS

Sable silty clay loam from western Illinois has nearly ideal physical and chemical properties for plant growth. The more weathered Darmstadt silt loam from southern Illinois has chemical and physical properties that limit plant growth, especially the clayey (claypan) B2 horizon, the very strongly acid upper B, and a high Na content (natric horizon) in the mid- and lower B horizons that results in the dispersion of clay minerals.

The B2 mixture from the Darmstadt soil has the least favorable properties for plant growth because of its strongly acid pH, high content of expandable clays, and high exchangeable sodium levels. The 3-m mix and the top 3-m mix are very similar in properties and appear to be the most favorable materials for use in constructing the subsurface horizon of a post-mine soil. They have a higher pH, higher available P, and more favorable silt loam textures than the B2 mix. The 6-m mix has advantages over the B2 mix, including lower clay and exchangeable sodium contents. Both top 6-m and B2 mixes have similar available P contents. One disadvantage of the 6-m mix is its high pH (8.5) due to the presence of carbonates which could cause P and minor element availability problems.

The Sable soils differ from the Darmstadt soils in that the Sable B horizon materials do not have serious chemical or physical problems which limit plant growth. The B horizon material does have more clay than the underlying materials. Although that clay content is not high enough to be deleterious in the undisturbed soil with its genetic structure intact, the silt loam texture of the deeper loess might be preferable in a newly constructed soil. In other respects, the Sable B horizon material appears to be as favorable or more favorable than the deeper materials for use in soil construction. The presence of free carbonates in the substratum materials would be a disadvantage, although not a terribly serious one. Although reserve P is highest in the substratum loess, available P is highest in the Sable Ap and B2 horizons. In summary, the data indicate that the Sable B horizon is favorable for use in subsoil construction but that substratum material is also of high quality. Greenhouse and field studies are needed to determine the effects of mixing these materials.

Mixing the A horizon throughout the top 3 m of both Sable and Darmstadt soils only slightly enhances the chemical and physical properties of the top 3-m mixtures. On the other hand, segregating the A horizon and replacing it at the top of a reconstructed soil makes seedbed preparation and fertility management easier.

Comparison of the tested and calculated soil values indicate that most chemical and textural properties of a solum and subsolum mixture can be predicted with reasonable assurance prior to mining by analyzing the individual horizons included in the mixture. During the process of mining and reclamation, this approach would be most applicable where rather complete mixing of materials is accomplished, as would be expected where a mining wheel was used. Where poor mixing is expected, predictions should be made with less confidence.

ACKNOWLEDGMENT

This work was supported by funds from the State of Illinois, Amax Coal Company, Consolidation Coal Company, Freeman United Coal Company, Peabody Coal Company, Robertson and Associates, Southwestern Illinois Coal Company, and the Illinois Agricultural Association.

LITERATURE CITED

1. Aldon, E. F. 1978. Reclamation of coal-mined land in the Southwest. J. Soil Water Conserv. 33-2:75–79.
2. Allison, L. E. 1965. Organic Carbon. *In* C. A. Black et al. (ed.) Methods of soil analysis, part 2. Agronomy 9:1367–1400. Am. Soc. of Agron., Madison, Wis.
3. Andrew, L. E., and H. F. Rhoades. 1947. Soil development from calcareous glacial material in eastern Nebraska during 75 years. Soil Sci. Soc. Am. Proc. 12:407–408.
4. Brady, Nyle C. 1974. Soil reaction: acidity and alkalinity. p. 386–391. *In* The nature and properties of soils. MacMillan Publishing Co., Inc., New York.
5. Chepil, W. S., and N. T. Woodruff. 1963. Physics of wind erosion and its control. Adv. Agronomy. 15:211–302.
6. Dancer, W. S., and I. J. Jansen. 1981. Greenhouse evaluation of solum and substratum materials in the southern Illinois coal field: I. Forage crops. J. Environ Qual. 10:396–400.
7. Holmgren, G. S., R. L. Juve, and R. C. Geschwender. 1977. A mechanically controlled variable rate leaching device. Soil Sci. 41:1207–1208.
8. Kilmer, V. J., and L. T. Alexander. 1949. Methods of making mechanical analysis of soils. Soil Sci. 68:15–24.
9. Kinter, E. B., and S. Diamond. 1956. A new method for preparation and treatment of oriented aggregate specimens of soil clays for x-ray diffraction analysis. Soil Sci. 81:111–120.
10. Knudsen, D. 1975. Recommended phosphorus soil tests. Recommended chemical soil test procedures for the north central region. Bulletin no. 499. Fargo, N. Dak. Agric. Exp. Stn.
11. Laverty, J. C. (ed.) 1962. The Illinois method for determining available phosphorus in soils. Dep. of Agronomy, Univ. of Illinois, Urbana-Champaign.
12. McSweeney, K., I. J. Jansen, and W. S. Dancer. 1981. Subsurface horizon blending: an alternative strategy to B-horizon replacement for the construction of post-mine soils. Soil Sci. Soc. Am. J. 45:794–799. (this issue).
13. Peech, M., L. T. Alexander, L. A. Dean, and J. F. Reed. 1947. Methods of soil analysis for soil fertility investigations. Circular no. 757, USDA. U.S. Government Printing Office, Washington, DC.
14. Power, J. F., F. M. Sandoval, and R. E. Ries. 1978. Restoration of productivity to disturbed land in the northern Great Plains. *In* J. R. Wright (ed.) Reclamation of disturbed arid lands. Am. Assn. for Adv. Soil, Washington, DC.
15. Sandoval, F. M., J. J. Bond, J. F. Power, and W. O. Willis. 1973. Lignite mine spoils in the northern Great Plains. Characteristics and potential for reclamation. p. 117–133. *In* Proc., Res. and Applied Tech. Symp. on Mined-land Reclamation. Natl. Coal Assn. Washington, DC.
16. U. S. Salinity Laboratory Staff. 1954. L. A. Richards (ed.) Diagnosis and improvement of saline and alkali soils. Agric. Handb. no. 60, USDA. U.S. Government Printing Office, Washington, DC.

Reprinted from the *Soil Science Society of America Journal*
Volume 45, no. 4, July-August 1981
677 South Segoe Rd., Madison, WI 53711 USA

Subsurface Horizon Blending: An Alternative Strategy to B Horizon Replacement for the Construction of Post-Mine Soils[1]

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ABSTRACT

This study was initiated to evaluate various combinations of substratum and B horizon materials, as subsurface rooting media. Materials were collected from each solum and substratum horizon to a depth of about 6 m at two surface mine sites. One of the sites was in southern Illinois and had an infertile Darmstadt (Albic Natraqualf) surface soil with a strongly acid (pH 5.2) and natric subsoil. The other was in west central Illinois and had a Sable (Typic Haplaquoll) surface soil which supports high yielding grain crops with proper management.

The experiment was conducted in a greenhouse using large plant containers. The test crop, soybean, was germinated in A horizon material, or in a blend of materials containing A horizon, placed over the given surface rooting medium. This procedure was employed in order to simulate field conditions where seeds germinate in topsoil and root into the underlying material. Performance of the test crop was best where A horizon was segregated and replaced over a blend of the next 3 m of material for treatments made from the Darmstadt materials from southern Illinois. It was poorest where A horizon material was replaced over material from the Darmstadt B_2 horizon. The other treatments were intermediate in performance between the A/Top 3 m and the A/B_2 (subsoil). A similar trend was found with the Sable materials from west central Illinois, but the difference between the best performing treatment, A/Top 3 m, and the poorest, A/B_2 (subsoil), was not as marked.

Additional Index Words: clay pan soils, disturbed soils, mine spoil, prime farmland, surface mine reclamation.

McSweeney, K., I. J. Jansen, and W. S. Dancer. 1981. Subsurface horizon blending: an alternative strategy to B horizon replacement for the construction of post mine soils. Soil Sci. Soc. Am. J. 45:794–799.

LITTLE ATTENTION has been given to use of substratum materials to substitute for or amend infertile acid horizons in highly developed soils because the cost of such extensive earth moving would generally be prohibitive. Such practices are feasible, however, when constructing soils after surface mining. Blending solum and substratum materials where desirable for use in soil construction would be little or no more expensive in some instances than segregating and replacing soil horizons in sequence.

Environmental protection performance standards enacted as part of the Federal Surface Mining Control and Reclamation Act of 1977-Public Law 95-87 (12) require that the A and B horizon of a natural soil be segregated and replaced when prime farmland is disturbed by surface mining for coal. There is, however, provision within the act for the use of underlying strata in combination with or in place of the B horizon of the natural soil. These alternatives must be shown to be "both texturally and chemically suitable for plant growth and . . . to be equally or more favorable for plant growth than the B horizon . . ." (12).

Many of the prime agricultural soils in southern Illinois (7) destined to be disturbed by surface mining have strongly-to-very-strongly acid infertile and sometimes natric subsoil horizons. It has been suggested that a blend of subsoil and selected components of the underlying substrata could produce a subsurface rooting media that would be equal to or more favorable for plant growth than the B horizon with its inherent clay pan (2).

Workers in other areas (3, 4, 9, 10, 11, 13) have reported improvements in soil properties following the addition of selected favorable soil or unconsolidated material to problem soils. Notable improvements include the moderation of extremes of pH (3, 4, 11) and the improvement of infiltration capacity (9, 10).

This study was initiated to evaluate various combinations of substratum and B horizon materials as subsurface rooting media. Materials were collected from each solum and substratum horizon to a depth of about 6 m at two surface mine sites. One of the sites was in southern Illinois and had a soil with a strongly acid infertile natric subsoil (7). The other was in west central Illinois and had a soil capable of supporting high yielding grain crops with good management (6).

The experiment was conducted in a greenhouse using large plant containers. The test crop, soybean

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[1] Contribution from the Dep. of Agron., Univ. of Illinois, U-C Campus, Urbana. Part of a thesis submitted by the senior author in partial fulfillment of the requirements of the M.S. degree at the Univ. of Illinois. Received 18 Mar. 1981. Approved 30 Mar. 1981.

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(*Glycine max* L.), 'Williams' variety, was germinated in A horizon material, or in a blend of materials containing A horizon, placed over the given subsurface rooting media. This procedure was employed in order to simulate field conditions where seeds germinate in topsoil and root into the underlying material.

MATERIALS AND METHODS

Material Collection and Preparation

A Darmstadt soil (Albic Natraqualf; fine, montmorillonitic, mesic) and a Sable soil (Typic Haplaquoll; fine-silty, mixed, mesic) were selected from the Captain Mine, Perry County, southern Illinois and from the Mecco Mine, Knox County, west central Illinois, respectively. The soils and substrata were sampled according to the horizon divisions indicated on Tables 1 and 2 and stored in closed plastic storage containers for 6 weeks at a temperature of between 12.5 and 15.5°C.

Considerable care was taken during preparation of the materials to preserve their physical and chemical integrity. The objective, while avoiding excessive pulverization during preparation, was to achieve a suitable consistency without allowing the materials to become completely air dry.

All materials were passed through a 20-mm stainless steel wire mesh screen to break down the larger clods, to facilitate mixing, and to avoid the formation of large voids when the materials were placed in the plant containers. Some of the materials were sieved upon removal from the storage containers. Others had to be dried somewhat to achieve favorable tilth. These materials were prevented from becoming excessively dry by frequent turning during the day and coverage with plastic sheets at night. The B_2 materials from both sites and the IIIB (paleosol) materials from the southern site were especially difficult to work. A suitable physical condition was achieved in these materials by the use of two freeze–thaw cycles.

Six different combinations of materials for use in constructing subsurface blends were prepared for each of the two mine sites. This was done by blending materials from the various solum and substratum horizons at each site in different proportions by volume. The composition of each subsurface blend is indicated in Tables 1 and 2; selected soil test values are shown in Table 3. The detailed physical and chemical characterizations of the soil blends and horizon components is contained in a companion paper (11).

Table 1—Simplified horizon designation of Darmstadt soil showing components of each subsurface blend.

	Horizon	Texture	pH	Depth, cm	Material	
	A	Silt loam	6.1	0–36	Surface soil	
A/B2	B2‡	Silty clay loam	5.2	36–94	Subsoil	
	B3‡	Silt loam	7.9	94–155	Subsoil	Top 3-m mix†
A/Top 3 m	IIB3	Silt loam	8.2	155–262	Mixed Roxana loess	
	IIIA	Silty clay loam	7.4	262–296	Paleosol	A/Top 6 m
A/Bottom 3 m	IIIB	Clay loam	8.1	296–544	Paleosol	A/IIIB
	IIIC	Loam	8.4	544–606 +	Calcareous till	

† A-horizon material incorporated throughout blend.
‡ Exchangeable Na >15%.

Table 2—Simplified horizon designation of Sable soil showing components of each subsurface blend.

	Horizon	Texture	pH	Depth, cm	Material	
†Top 3-m mix	A	Silt loam	5.5	0–43	Surface soil	
A/B2, B3	B2	Silty-clay loam	6.2	43–107	Subsoil	A/B2
	B3	Silt loam	7.7	107–140	Subsoil	A/Top 3 m
A/C, IIC	C	Silt loam	8.1	140–338	Calc. loess	
	IIC	Silt loam	7.7	338–445	Calc. loess	A/Top 6 m
	IIIA	Silt loam	7.5	445–483	Paleosol	
	IIIB	Clay loam	7.8	483–594	Paleosol	
	IIIC	Loam	8.1	594–633 +	Calc. till	

† A horizon material incorporated throughout blend.

Table 3—Selected soil test values for Darmstadt and Sable soil mixtures.

	Bray P_1‡	$CaCO_3$ equiv.	pH 1:1	Exchangeable cations K‡	Exchangeable cations Na	Exchangeable cations Ca	Particle size distribution (2 mm) Sand	Particle size distribution (2 mm) Silt	Particle size distribution (2 mm) Clay
	kg/ha	%		meq/100 g	meq/100 g	meq/100 g	%	%	%
				Darmstadt silt loam (Albic Natraqualf)					
Total A	10	0	6.1	0.09	0.65	6.50	3.7	83.4	12.9
B2 mix	12	0.1	5.2	0.32	3.43	11.03	1.6	61.4	37.0
Top 3-m mix†	37	0.1	6.7	0.15	2.63	8.97	1.1	74.2	24.7
3-m mix	41	0.1	6.9	0.23	2.94	11.21	0.9	72.3	26.8
6-m mix	13	1.0	8.3	0.26	1.32	16.40	19.2	53.7	27.1
Sang. B mix	6	0.2	8.1	0.13	0.65	11.04	24.1	48.8	27.1
Btm. 3-m mix	6	1.6	8.3	0.29	0.66	18.96	21.7	51.7	26.6
				Sable silty clay (Typic Haplaquoll)					
Total A	26	0	5.5	0.31	0.18	17.53	6.9	58.5	34.6
B2 mix	31	0	6.2	0.27	0.13	16.27	7.7	59.8	32.5
Total B mix	21	0.8	7.7	0.23	0.44	15.71	1.1	69.2	29.7
Top 3-m mix†	11	7.4	7.9	0.30	0.18	18.43	1.1	76.9	22.0
3-m mix	9	7.8	8.0	0.30	0.21	13.25	0.4	79.7	19.9
6-m mix	7	5.2	8.0	0.19	0.25	17.59	10.8	65.5	23.7
C-loess mix	8	5.9	8.1	0.21	0.19	12.37	6.9	76.3	16.8

† A horizon material incorporated throughout blend.
‡ Established nutrient ranges for Illinois soils (kg/ha):
Bray P_1: Low 0–11, slight 12–22, medium 23–34, high 35 +.
Potassium: Low 0–202, slight 203–269, medium 270–336, high 337 + (K meq/100 g × 674 = K kg/ha).

Plant containers were constructed from high density polyethylene tubing (Fig. 1). The components of each blend were mixed together in a cement mixer for three minutes. The blends were introduced into the plant containers through a long-necked funnel to minimize separation of the various constituents. To encourage settling, a vibrator was applied to the outside of each column after each 20-cm increment of material had been added. Thus, each subsurface blend was subjected to the same compactive force, but bulk density was not necessarily the same because each was composed of materials of differing particle-size ranges. Each subsurface blend was replicated eight times. Two hundred ml of distilled water was applied to each container daily until free drainage was observed at the base of each. This amount of water was kept constant within subsurface blends.

The same volume of surface material (1,650 cm^3) was placed on top of each subsurface blend (Fig. 1). The surface material constituted the appropriate A horizon in all but the two top 3-m mixes where the A horizon was already incorporated into the blend. In this latter instance, the appropriate amount of fresh Top 3-m mix was placed on top of the subsurface blend in the same manner as for the other blends. A fertility treatment equivalent to 100-kg/ha lime, 75-kg/ha P, and 94.5-kg/ha K was applied to the surface component of one-half the replicates of each subsurface blend. Thus, for materials from both the Sable and Darmstadt sites, six subsurface blends, one-half with a fertilized surface horizon and one-half with an unfertilized surface horizon, were constructed, resulting in 12 treatments each.

Environmental Control, Planting, and Harvesting

The columns having fertilized and unfertilized surface material placed over Darmstadt and Sable subsoil and substratum materials were each arranged in randomized complete blocks in adjacent benches in the greenhouse. Temperature was maintained at a minimum of 21°C during the night (8:00 P.M. – 6:00 A.M.) and 25.5°C during the day (6:00 A.M. – 8:00 P.M.).

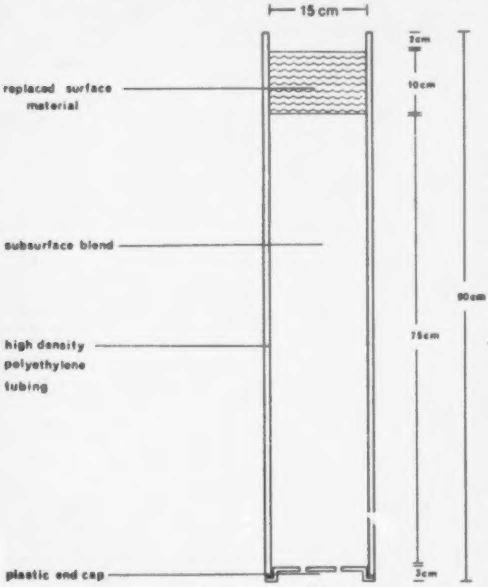

Fig. 1—Plant container showing relationship of surface material to subsurface blend.

Four 'Williams' (Wayne XL 57-0034, 1972) variety soybean (*Glycine max* L.) seeds previously soaked in liquid Rhizobium inoculum (supplied by Urbana Laboratories, Urbana, Ill.) were planted at a 2-cm depth in each column. At the time of seeding, 150 ml of distilled water was applied to each column. The majority of the seedlings emerged 3 to 4 days after planting; percent emergence on the different soil treatments is given in Tables 4 and 5. The subsequent soybean development was recorded according to the method of Fehr and Caviness (5). When the seedlings had reached the V1 stage they were thinned, leaving one in each column. Artificial illumination was operative during the day, from emergence-VE stage until the majority of plants had reached the R3 stage, the onset of pod formation.

The water status of the plant containers was monitored by tensiometers installed at a soil depth of 60 cm in one replicate of each treatment. An adequate watering regime was maintained during the majority of the vegetative stage, VE to V8, by applying 150 ml of distilled water three times per week. The watering regime was then increased to four applications of 200 ml per week to compensate for the increase in evapotranspiration caused, in part, by an increase in daytime temperatures. A drought stress, which is common in the latter half of the growing season on reclaimed soils in Illinois, was imposed soon after the majority of plants had reached the full pod-R4 stage. All treatments were limited to one 150-ml application of distilled water during a 6-day period. The previous watering regime was resumed at the conclusion of the drought stress.

The plants were harvested when the majority of the plants had reached full seed-R6 stage, by cutting the main stem 1.25-cm above the soil surface. Plant height was recorded and then the above-ground portions of the plants were dried in an oven (60 to 70°C) for 6 days. Standing-crop (stem, leaves, and pods) weight determinations were made on each plant. Pod weight was then recorded for each plant to give an estimate of yield. The bottom ends of two plant containers randomly chosen from each treatment were examined to observe extent of root penetration and moisture status.

RESULTS AND DISCUSSION

Plant height provided an indication of performance and was most useful during the early growth stages. Most of the general trends reflected in the weight data (Tables 4 and 5) were evident at the 5 week-V5/V6 stage (5) in the height data. By the 10th week-R4 stage, however, individual plants were exhibiting noticeable variation in pod number, height, and extent of branching. By harvest time, treatment differences were more clearly expressed by standing crop and pod weight than plant height.

Previous work by Dancer and Jansen (2) using materials from a surface mine in southern Illinois has shown that some subsurface materials were more responsive to added fertilizer than others. In this study, the fertilized treatments performed significantly better ($P = 0.05$) overall with respect to yield (pod weight) and standing crop (stems, leaves, and pods) than the unfertilized treatments, but this difference was not reflected in the seedling emergence data. The following fertilized Darmstadt soil materials performed better than their unfertilized counterparts, A/B2, A/Bottom 3 m, and A/Top 6 m. The subsurface blends of these treatments are low in natural fertility which could explain the marked response to fertilization. From the Sable materials, only the Top 3-m mix (no discrete A horizon replaced at surface) showed a significant response to fertilization. The overall performance ranking of the various soil blends was similar for both fertilized and unfertilized treatments. Thus, the remainder of the discussion will consider the fertilized and unfertilized treatments of a given subsurface blend together.

Table 4—Performance of soybeans grown in soil columns containing A horizon material† placed over various subsurface rooting media made from soil and substratum components of a Darmstadt soil.

Treatment	Emergence*	Standing crop mean wt.*	Yield (pods) mean wt.*	Yield/standing crop ratio
	%	g	g	
		Fertilized treatments‡		
A/Top 3 m	75 ab	24.22 a	7.70 a	31.8
A/Sang. B	81 a	23.53 a	6.34 b	26.9
A/Top 6 m	75 ab	23.04 a	6.35 b	27.6
Top 3-m mix	44 bc	22.40 ab	5.73 b	25.6
A/Bottom 3 m	69 ab	20.05 b	5.86 b	29.2
A/B2	56 b	15.24 c	4.49 c	29.5
		Unfertilized treatments		
A/Top 3 m	75 a	23.89 a	6.64 a	27.8
A/Sang. B	69 ab	22.12 ab	6.11 ab	27.6
A/Top 6 m	69 ab	20.11 b	5.47 abc	27.2
Top 3-m mix	38 c	20.42 b	5.07 bc	24.8
A/Bottom 3 m	63 ab	16.49 c	4.79 c	29.1
A/B2	50 bc	12.02 d	3.53 d	29.3

* Values followed by different letters are significantly different at the 0.05 level of probability according to Fisher's L.S.D.

† In Top 3-m mixes, A horizon material is incorporated throughout the blend.

‡ Surface material to a depth of 10 cm fertilized with lime, P, and K.

Table 5—Performance of soybeans grown in soil columns containing A horizon material† placed over different subsurface rooting media made from soil and substratum components of a Sable soil.

Treatment	Emergence*	Standing crop mean wt.*	Yield (pods) mean wt.*	Yield/standing crop ratio
	%	g	g	
		Fertilized treatments‡		
A/Top 3 m	81 a	26.21 a	9.02 a	34.4
A/Top 6 m	75 a	25.76 a	8.78 ab	34.1
A/C, loess	81 a	25.57 a	8.61 ab	33.7
A/Total B	75 a	24.68 ab	8.01 abc	32.5
Top 3-m mix	56 b	24.12 ab	7.64 bc	31.7
A/B2	75 a	22.16 b	7.15 c	32.3
		Unfertilized treatments		
A/Top 3 m	75 a	23.74 a	7.97 a	33.5
A/Top 6 m	75 a	23.77 a	7.68 ab	32.3
A/C, loess	75 a	22.86 ab	7.93 ab	34.7
A/Total B	69 ab	22.09 ab	7.67 ab	34.7
Top 3-m mix	56 b	20.40 b	6.84 ab	33.5
A/B2	63 ab	20.96 b	6.53 b	31.2

* Values followed by different letters are significantly different at the 0.05 level of probability according to Fisher's L.S.D.

† In Top 3 m mixes A horizon is incorporated throughout the blend.

‡ Surface material to a depth of 10 cm fertilized with lime, P and K.

Darmstadt Site

The Darmstadt soil (Table 1) is a relatively highly weathered soil formed in loess, with a moderately dark surface layer (A horizon). The subsoil (B2 and B3) horizon is high in clay (32%), characteristically sticky, plastic when wet, and it is very hard when dry. The adverse physical problems are further compounded by relatively high levels of exchangeable Na (Tables 1 and 3). The silty clay loam subsoil is inherently infertile with a strongly acid upper B. Infiltration of water is slow in these soils, and root growth is restricted in the subsoils if they are chemically unamended (7). A transitional zone, the mixed Roxana loess (IIB3) horizon and Sangamon paleosol till A horizon (IIIA), underlies the subsoil. It contains less clay (24%) and is higher in nutrients than the overlying subsoil (11). Glacial till underlies the transitional zone and is composed of the Sangamon paleosol B horizon (IIIB) which has a clay loam texture and the relatively unweathered loamy calcareous till (IIIC).

Soybean productivity was lowest on the A/B2 (subsoil) treatments. The subsurface material of these treatments had an appreciably higher clay, exchangeable Na content, and acidity than the other subsurface blends made from the Darmstadt materials (Table 3). The surface material of these treatments was frequently saturated; it ponded following irrigation, which severely limited plant performance. Seedling emergence of the A/B2 (subsoil) treatments was low compared to the other treatments except for the Top 3-m mixes (Table 4). Oxygen deficiency was probably one factor which caused lower plant emergence in the water-saturated surface materials. The A/B2 (subsoil) treatments performed poorest with respect to both standing crop and pod weight (Table 4). Examination of the plant roots from these treatments showed them to be very poorly developed and consequently only a small soil volume was available for nodulation and intake of water and nutrients. In contrast, root development in the other treatments was much more extensive, proliferating throughout and to the bottom of the plant container. A more extensive soil volume for nodulation and exploitation of nutrient and water resources was thus provided. This is suported by the tensiometer data. The tensiometers installed (60-cm soil depth) in the A/B2 (subsoil) treatments remained in range throughout the whole experiment, indicating that roots were not effectively exploiting moisture at that depth. Those in all the other treatments went out of range (below 1 bar) over a 10-day period between the R3 and R5 stage.

Soybeans grown on the A/Top 3-m treatments performed best overall (Table 4). The subsurface blend pH (6.8) is in the optimal range for soybean growth, and these treatments also benefited from a balanced nutrient supply and a good texture (11). The Top 3-m mix, A/Top 6-m, and A/Sang. B (paleosol) treatments were intermediate in performance (Table 4). These treatments all had good physical properties, but the A/Top 6-m and A/Sang. B (paleosol) treatments had subsurface blends with high pHs', 8.2 and 8.1, respectively (11).

In the Top 3-m mix treatment, where A horizon was not segregated and replaced at the surface, water management was a problem. Seedling germination was slow and plant emergence was very low in these treatments (Table 4). This may be partly attributable to slow and limited water infiltration and a poor soil-seed contact. Treatments with a lower surface organic matter content were subject to periodic surface crusting throughout the course of the experiment. Soybean growth on the Top 3 m-mix treatments was limited by poor water infiltration, especially after flowering. The evapotranspiration was much higher during this period of pod and bean development. Plants in this treatment lagged physiologically behind the plants of the other treatments. This could at least explain the lower yield/standing crop ratio. Plant growth on these materials, however, was superior to those grown on the A/B2 treatments.

The subsurface blend of the A/Bottom 3-m (till) treatments has a high pH (8.3), induced by the presence of free carbonates. Mortvedt (8) has suggested that the availability of N, K, Cu, Fe, and Zn could be reduced under conditions of high pH induced by calcium carbonate. The soybeans grown on these treatments exhibited no marked signs of specific nutrient deficiencies, but overall performance was poor. Perhaps the presence of the fertile A horizon masked any nutrient deficiencies that might otherwise have been apparent.

Sable Site

Sable soil (Table 2) has a black silty clay loam surface (A horizon), rich in organic matter and natural fertility. The subsoil (B2) horizon is a light brownish gray silty clay loam. The soils have moderate permeability and a very high available water capacity (6). The subsoil is underlain by the following horizons: calcareous loess (C and IIC); Sangamon paleosol (IIIA and IIIB); and calcareous glacial till (IIIC). All these substratum materials have favorable textural properties and are alkaline, although the paleosol contains no free carbonates (Table 3).

The contrast in performance between the various Sable treatments (Table 5) was not as marked as for the Darmstadt treatments. Roots proliferated throughout and extended to the bottom of the containers in all Sable treatments. All the tensiometers went out of range (below 1 bar) over a 12-day period between the R3 and R5 stage.

It is somewhat surprising that plants grown on the A/B2 (subsoil) treatment were lowest in the given measures of performance, because the physical properties of this treatment did not differ greatly from the other treatments (11). The clay content of the subsurface component of these treatments, though not excessively high, is somewhat higher than that of the other treatments, and occasional surface saturation was a problem.

The A/Top 3-m, A/Top 6-m, A/C Loess (calcareous), and A/Total B (subsoil) treatments supported the best overall plant growth with respect to both standing crop and pod weight (Table 5). It had been hypothesized prior to the experiment that the presence of free carbonates in the subsurface blends of all these treatments (except the A/Total B) would have adversely affected nutrient availability (8). Again, the presence of a fertile A horizon may have masked any adverse nutrient unavailability that might otherwise have been apparent. The subsurface blends of these treatments (A/Top 3 m, A/Top 6 m, A/C Loess, and A/Total B) all had favorable silt loam textures and pH's not exceeding 8.1 (Table 3). The reason for a beneficial effect from mixing deeper materials with Sable B2 horizon material is not readily apparent from the physical and chemical data.

Performance of the Top 3-m mix treatments (no discrete A horizon replacement) as with the corresponding Darmstadt treatments was likely inhibited by the problem of water management. Low and slow seedling emergence resulting in physiological lag can be partly attributed to slow and limited water infiltration and a poor soil-seed contact. Surface crusting and poor water infiltration was also a problem during other critical growth stages.

CONCLUSIONS

Large container experiments with soybeans, grown in the greenhouse on various combinations of soil horizons and underlying unconsolidated materials, support the following general conclusions:

1. The Darmstadt soil has a strongly acid (pH 5.2) and natric subsoil that can be amended by blending in the less acid and less sodic materials from the substratum. The best performance was achieved by segregating and replacing the A horizon over a blend of the next 3 m of material. Poorest performance was from the treatment consisting of A horizon material replaced over disturbed B2 horizon material. Treatments which included materials from below 3 m, or which had an A horizon material blended with the balance of material in the Top 3 m, rather than segregated and replaced, were intermediate in performance. The observed relationships are in general agreement with what might be predicted on the basis of the physical and chemical properties of the materials.
2. Soybean performance with materials from the Sable soil was better when A horizon material was segregated and replaced over a mix of the next 3 m of material than when it was replaced over disturbed B2 horizon material. Plant growth differences were not as great as those observed on materials from the Darmstadt site.
3. Segregation and replacement of A horizon material at the surface facilitated water management and gave a favorable response when all other factors were constant. With materials from the Darmstadt soil, however, a blend of the Top 3 m without A horizon segregation and replacement was a superior medium for plant growth than the treatment consisting of A horizon and B2 horizon materials segregated and replaced in sequence.
4. A treatment consisting of a Darmstadt A horizon replaced over material from the Sangamon B horizons (IIIB) compared favorably with other treatments. This suggests that there is no need to exclude the Sangamon B2 material from mixes to be used for subsurface horizons in constructed soils. It is important to note that, at this site and commonly in southern Illinois, the Sangamon paleosol has been resaturated with carbonates leached from the loess mantle.
5. Fertilization improved the performance of all treatments, notably those with subsurface blends low in natural fertility; but it did not change the relationship between corresponding fertilized and unfertilized treatments.

These results suggest that for some mining areas, particularly in southern Illinois, selective subsurface horizon blending would produce a better post-mine soil than segregation and replacement of the B horizon from the natural soil. This is consistent with what would be predicted on the basis of the physical and chemical properties of the various materials available at these sites. Areas where subsurface horizon blending is likely to be beneficial can be readily identified by interpreting soil maps. The alternative material substitution option provided for in Public Law 95-87 (12) should be considered for these mining areas.

There is reason to expect that post-mine soils carefully constructed by blending selected subsurface horizons to dilute or favorably amend undesirable material will eventually be superior to the natural soils in some areas. Further work is needed to determine the productivity of such constructed soils under field conditions and their response to varying environmental factors.

ACKNOWLEDGMENTS

This work was supported by funds from the State of Illinois, Amax Coal Company, Consolidation Coal Company, Southwestern Illinois Coal Company, Freeman United Coal Company, Peabody Coal Company, and the Illinois Agriculture Association.

LITERATURE CITED

1. Bocskai, J. 1974. The effect of multilayer reclamation on meadow Solonetz soils turning into steppe formation. Agrokemia es Talajtan 23 (Supplement):191–200. *In* Soils Fert. (1975) 38:7, Ref. 2410.
2. Dancer, W. S., and I. J. Jansen. 1981. Greenhouse evaluation of solum and substratum materials in the southern Illinois coal field. I. Forage Crops. J. Environ. Qual. 10:396–400.
3. Dollhopf, D. J., C. J. Levine, and B. J. Bauman. 1979. The effect of spoil mixing on the dilution of toxic overburden zone. p. 27–28. A.S.A. Agronomy Abstracts.
4. Dzubay, M. 1971. Investigation on the effect of chemical amelioration of soils on the experimental field at Cserebokemj (In Hungarian). Agrokemia es Talajtan 20 (3):261–280. *In* Soils Fert. (1972) 35:4, Ref. 3414.
5. Fehr, W. R., and E. Caviness. 1977. Stages of soybean development. Special Report no. 80, Coop. Ext. Service, Agric. and Home Econ. Exp. Stn., Iowa State Univ., Ames.
6. Fehrenbacher, J. B., I. J. Jansen, B. W. Ray, J. D. Alexander, and T. S. Harris. 1977. Soil associations of Knox Co., Illinois. Special Publication no. 46. College of Agric., Univ. of Illinois, Urbana-Champaign.
7. Miles, C. C., B. W. Ray, and W. R. Oschwald. 1970. Soil associations of Perry County, Illinois. Circular no. 1018, Coop. Ext. Service, Univ. of Illinois, Urbana-Champaign.
8. Mortvedt, J. J. 1976. Soil chemical constraints in tailoring plants to fit problem soils. 2. Alkaline soils. p. 141–149. *In* M. J. Wright and S. A. Ferrari (ed.) Plant Adaptation to Mineral Stress in Problem Soils. Cornell Univ. Press, Ithaca N.Y.
9. Ries, R. E., F. M. Sandoval, and J. F. Power. 1977. Reclamation of disturbed lands in the lignite area of the Northern Plains. p. 309-327. Proc. Symp. on Technology and Use of Lignite. May 1977, Grand Forks, N.D. ERDA-UND, Grand Forks, N. D.
10. Schuman, G. E., and E. M. Taylor, Jr. 1978. Use of mine spoil material to improve topsoil. Wyoming Agri. Exp. Stn. Res. J. 150, Laramie.
11. Snarski, R. R., J. B. Fehrenbacher, and I. J. Jansen. 1981. Physical and chemical characteristics of pre-mine and post-mine soil mixtures in Illinois. Soil Sci. Soc. Am. J. 45: 806–812.
12. United States. 1979. Surface mining control and reclamation act of 1977. Section 515:6–7. United States Statutes at Large 91:487–488. U.S. Government Printing office, Washington, DC.
13. Verhoeven, B. 1973. Acid sulphate soils in the Wieringemeer Polder, a good 40 years after reclamation. *In* Acid Sulphate Soils. (1973). Inter. Inst. for Land Reclamation and Improvement 2:114–128. Wageningen, The Netherlands.

From Mining Magazine, May 1980

THE ARCH MINERAL CAPTAIN MINE — RECLAMATION INNOVATIONS FOR THE 80'S

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SINCE the early days of surface coal mining in the United States near Danville, Illinois in 1865, this industry has flourished in the Mid-West. The broad, gently rolling prairie which covers the thick, flat coal seams of Illinois allows the maximum recovery of this important energy resource. During 115 years of mining activity the coal industry has weathered market cycles from boom to bust, whilst steadily improving efficiencies and methods. The equipment employed has scaled up in size from the early small steam shovels to the present day giant walking draglines.

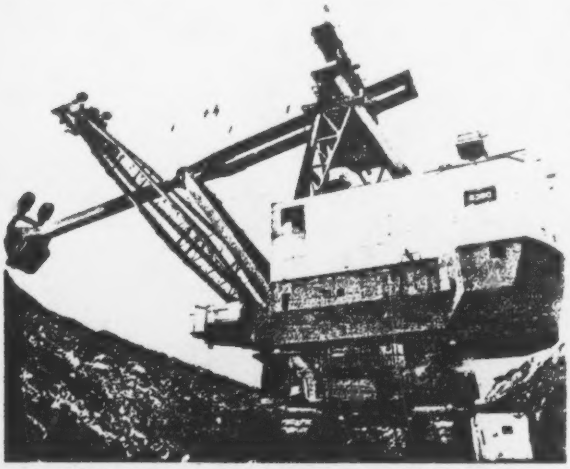
Engineering for the recovery of coal, for haulage, for preparation, and for reclamation has become more exacting and more crucial to the success of the enterprise year by year. Economic considerations have necessitated larger equipment, customers have demanded stable production and legislation requires a high performance in reclamation. At the Southwestern Illinois Coal Corporation Captain Mine some 70 miles southeast of St. Louis, Missouri, a major technical leap forward is being taken with the installation of bucket wheel excavators and shiftable conveyors to facilitate efficient and high standards of land reclamation.

The Southwestern Illinois Coal Corporation is a subsidiary of Arch Mineral Corporation, based in St. Louis, Missouri. In addition to the Southwestern operations at the Captain and Streamline mines, Arch Mineral has coal producing properties in Alabama, Wyoming and, hopefully soon, in New Mexico. Arch Mineral, named after the famous "Gateway Arch" in St. Louis, purchased Southwestern Illinois Coal Corporation in 1972. Combining scale, stability and performance to what was a conventional large scale stripping operation, Arch Mineral has recently integrated a bold combination of traditional American equipment with new German and Japanese wheel and belt systems.

Mine development

The fifteen year old Captain mine, operating in the heart of the Southern Illinois coal fields, has from the beginning projected a sense of bold engineering that paved the way for others to follow. In the 1960's the owners of Captain, wishing to capitalise on the two seams of strippable coal which together are over ten feet thick, helped develop mine equipment to ensure that both seams of coal would be uniformly recoverable. The result was the construction of Southwestern's giant Marion 6360 stripping shovel carrying a 180yd³ bucket. This machine, then assisted by a Marion 5561 parting shovel, began operations in October, 1965. More recently, a Harnischfeger P&H 5700LR stripping shovel was installed in the 6360 pit to dig the parting which is approximately 21ft thick and is predominantly limestone. This limestone has proved valuable, as it has helped to keep the water in the mined areas of good quality. In fact, pit water from the 6360 pit has been used to irrigate crops on the reclaimed land.

By 1969 the Captain mine was the largest bituminous coal mine in the country. The mine's early history included other bold initiatives such as the use of experimental 240 s. ton bottom dump haulage trucks which were driven in and out of the pit without having to turn around; these utilised dual engines, drive trains and steering. Southwestern's role as the area's largest employer was demonstrated by the use of mine land for the development of recreation areas, including camp grounds, a golf course with restaurant and lakes for fishing.



The Marion 6360 stripping shovel at the Captain Mine is one of the largest and heaviest open pit mining machines ever made. It has a 180yd³ bucket and a reach of 220ft from the crawlers.

In addition to the "6360" pit, the Captain Mine developed a second pit in 1977. This pit is equipped with a 100yd^3 Bucyrus-Erie 2570 dragline and throughout half the pit it is also a two seam operation. The parting is removed by a Marion 5561 with a 40yd^3 bucket. Both pits are currently mining towards each other across a 2,300 acre tract of land. Rimpull 135 s. ton capacity haul trucks and 150 s. ton Kress coal carriers move the coal to Southwestern's 2,800 s. ton/h McNally-Pittsburgh preparation plant. The trucks are loaded by Marion 151M, Marion 181M and Bucyrus-Erie 155B shovels. The coal seams are ripped before loading by Caterpillar 9H tractors.

The evolutionary history of mining in the area actually dates to the 1930's when Southwestern's Streamline mine was opened. Still operating, this mine is four miles northwest of the Captain mine and utilises a Marion 5761 shovel and a Marion 5560 converted to a cross-pit bucket wheel excavator. A second pit, newly developed in the summer of 1979, has a 70yd^3 Marion 8200 and is excavating an old area, which was mined earlier when equipment had far less depth capacity than it does now, to recover the lower coal.

The coal seams under the control of Southwestern, including the Captain and Streamline operations, comprise one of the largest strippable reserves east of the Mississippi River and mining operations are planned here well into the next century. The complex, in Perry and Randolph Counties in Illinois, is situated in one of the largest coal fields in the world. The State of Illinois has estimated reserves of more than 160 billion s. tons, of which over 30 billion are recoverable by present day technology. The state produces 50 million s. tons of bituminous coal each year, about one half of which is surface mined. Perry and Randolph Counties are the centre of the area where much of the surface mining of the state takes place and Perry County is, in fact, the State's largest coal producing county.

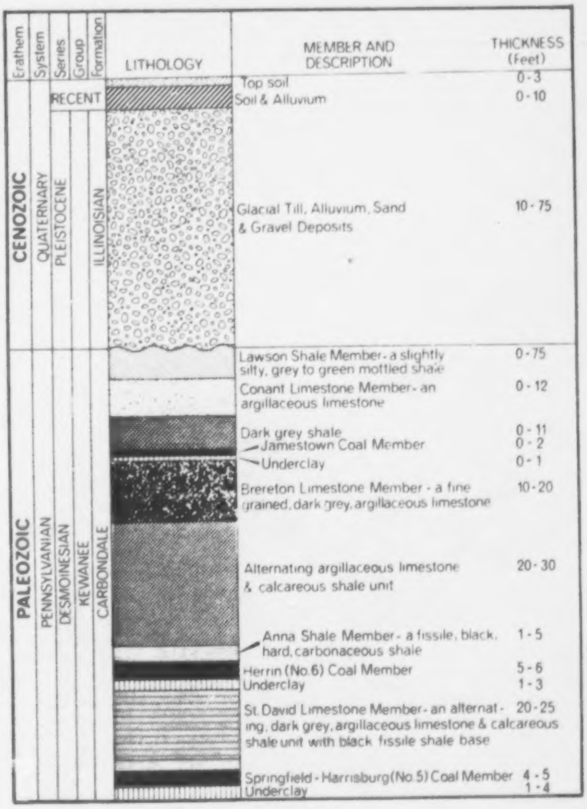
Ninety percent of the coal production in Illinois is from the prolific Herrin No. 6 and the Springfield-Harrisburg No. 5 coal seams. The No. 6 coal seam averages about 6ft in thickness and the No. 5 averages approximately 4ft. The coal is of high volatile bituminous rank and contains approximately 3% sulphur and 9.5% ash after it is washed. Newer power plants without scrubbers require a low sulphur coal and old power plants in Illinois, located in heavily populated areas, must burn similar coal. Because of the relatively high sulphur content of the No. 5 and No. 6 seams, this coal is used predominantly, therefore, by older power plants either under a pollution control variance or located in rural areas.

Coal from Southwestern is sold to a variety of electric utility companies including Illinois Power Company, Georgia Power Company, Missouri Public Service Company and the Northern Indiana Public Service Company. The coal is moved by the Illinois Central Gulf Railroad and the Missouri Pacific Railroad. In the case of the Georgia Power movement, the coal moves via the Missouri Pacific to Ford Dock on the Mississippi River below Chester, Illinois. The dock, which is leased by Arch Mineral, ships the coal to Pride Landing, Alabama, where it is loaded back into railroad cars for its trip to Georgia. Coal is moved up-stream from the Ford Dock into the Illinois River and to Illinois Power Co.

Soil structure

The land in this part of Illinois is much less productive than that found in the central and northern part of the State. Although a vast energy reservoir exists in the geologic structure, the surface of the earth has a diminished potential for agricultural productivity. Over the bedrock and coal, Illinoian glaciers left extensive glacial till deposits, a mixture of clay, silt, gravel and boulders. These till deposits vary in thickness, but average 50ft.

After the glacial ice period, a long period ensured of weathering and soil formation on the Illinoian till plain. A later glacial period, the Wisconsinan, did not penetrate southwards far enough to deposit till in the Perry County area. Therefore the characteristics of the more productive


Erathem
System
Series
Group
Formation
LITHOLOGY
MEMBER AND DESCRIPTION
THICKNESS (Feet)
CENOZOIC
QUATERNARY
RECENT
PLEISTOCENE
ILLINOISIAN
Top soil 0-3
Soil & Alluvium 0-10
Glacial Till, Alluvium, Sand & Gravel Deposits 10-75
PALEOZOIC
PENNSYLVANIAN
DESMOINESIAN
KEWANEE
CARBONDALE
Lawson Shale Member - a slightly silty, grey to green mottled shale 0-75
Conant Limestone Member - an argillaceous limestone 0-12
Dark grey shale 0-11
Jamestown Coal Member 0-2
Underclay 0-1
Brereton Limestone Member - a fine grained, dark grey, argillaceous limestone 10-20
Alternating argillaceous limestone & calcareous shale unit 20-30
Anna Shale Member - a fissile, black, hard, carbonaceous shale 1-5
Herrin (No.6) Coal Member 5-6
Underclay 1-3
St. David Limestone Member - an alternating, dark grey, argillaceous limestone & calcareous shale unit with black fissile shale base 20-25
Springfield - Harrisburg (No.5) Coal Member 4-5
Underclay 1-4

Stratigraphic column for Southwestern complex.

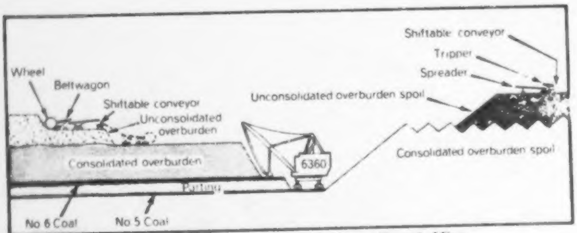
farm lands of central and northern Illinois are not found this far south in Illinois. The loess which covered much of the Illinoian till plain and the soil that had developed in it was blown from the floodplains of the swollen Mississippi and Missouri riverbeds. The loess comprises the topsoil (or "A" horizon) and is about 3 to 4ft thick in level areas around the Captain mine. A loamy zone occurs between the loess and underlying glacial till throughout much of Perry and Randolph Counties. This "B" horizon material is sandier than the loess and lacks many of the characteristics of richer till and buried soil formed by it. This loamy material is approximately 2ft thick and is very high in clay content. In fact, the principal characteristic of all of the soil associations in this area is that they all have this clayey subsoil layer. These soils absorb water slowly and rain tends to collect in depressions. This clay hardpan is practically impervious to water; it is sticky and plastic when wet but very hard when dry. Root growth is thus restricted on unfertilised moistened soils. Water movement from the mineral-rich subsoils below is similarly restricted.

For many years the farmers in these Southern Illinois counties have tried to break up this hardpan, realising that mixing it with the upper and lower soil horizons would provide much more freedom for root growth and considerably more potential for allowing the nutrients below the clay to infiltrate the entire soil structure and thus be more usable. Generally, however, breaking the hardpan has confounded the farmers; consequently, row crop productivity has never matched the central and northern parts of the state which benefited from the Wisconsinan till and an absence of the clay hardpan so close to the surface.

The first owners of Southwestern Illinois Coal Corporation also studied the geology of the soil. Finally, realising that these soils could perform better when mixed, they planted hardwood trees, which today after three decades exhibit markedly better growth characteristics than similar trees planted on virgin till. Proper management of the mined land along with the water resource has proven that even land mined prior to the present reclamation laws that has not been graded to approximate original contour can be utilised as a significant recreational and wildlife asset.

Reclamation mandates

In 1961, after operating in the area for over 25 years, a considerable amount of land was owned by Southwestern, either mined or land in the coal reserve. It seemed natural that this land resource should be properly managed, and Southwestern began farming operations, combining grazing quality mined land with land acquired for the reserve.



Diagrammatic view in cross section of the wheel system at Captain Mine.

Arch Farms now owns 2,800 head of free range cattle and 500 prime hogs, all raised and fed from the produce of the reclaimed areas. Wheat, sorghum, hay and soy beans have been harvested after one to two years. In 1976 hive bees were introduced and have produced good yields of honey.

At the time, the expanding surface mining industry was becoming an issue of social recognition in the farm belt and new reclamation methods were being researched and mandated. Since the first mine restoration law of 1962, reclamation methods and legislation have both been refined with requirements mandating more complete restoration of the mined land. This has culminated in recent regulations developed under the 1977 Surface Mine Control and Reclamation Act.

In Illinois, which is the largest exporting state for agricultural products in the U.S.A., the biggest issue in the passage of this legislation is whether surface coal operations can continue on prime farmland. The definitions of prime farmland are liberal enough to include virtually all of the soil types found on Southwestern's properties. In fact, in Illinois all surface mines have some land which could qualify as prime farmland. However, the high clay content soil of Southern Illinois makes reclamation performance on prime farmland that much harder.

This legislation and the traditional land use trilogy — cows, corn, coal — have set the stage for a performance mandate for the coal companies which must now not only reclaim the land to approximately the original contour but actually project row crop yields equal to that of the land prior to mining. Having accepted the policy and the mandate, technology must now be put to use for farming and mining to succeed in a mutually beneficial fashion. In Southern Illinois, Arch Mineral is developing a technology which will allow this harmony to succeed, by the use of bucket wheel excavators and belt transport systems. The logic is clear: this type of a system, integrated with the mining equipment allows deeper stripping, with contemporaneous reclamation and homogenising the three layers of soil, this mixing the clay hardpan. Compaction on the mined side once soils are replaced is unnecessary, and replacement of rubber tyred vehicles is minimised.

Development system

The genesis for the use of a bucket wheel and shiftable belt system was the cross-pit wheel excavator, developed by German and Russian engineers in the 1920's. These were adopted by two of the large coal companies operating in Illinois in the 1940's, the machines being designed according to the loading conditions permitted by the available shovel crawler chasis. The shovel counterweights were replaced by a discharge boom arranged on a slewable superstructure. This permitted a dumping distance from the centre of the bucket wheel to the discharge boom of well over 300ft. These machines could excavate blocks of soft material above the hard layer on top of the coal. Though these applications were installed before serious reclamation procedures commenced in Illinois in terms of grading and productivity standards, the effect of having a machine to excavate and replace the softer material above the consolidated overburden and rock proved conducive to reseeding and restabilising the area after the coal was removed. These older cross-pit bucket wheel excavators are still in continuous operation in Illinois including the one currently being used at Southwestern's Streamline mine. Other than the soft material restriction, the conventional cross-pit bucket wheel excavator is limited to the extent that the discharge boom has little flexibility in material placement. It can only work as a complement to the shovel, not as a continuous partner. The cross-pit conveyor poses severe utilisation limits on itself and other equipment in the pit due to overcrowding. In an area where mining has to go continually deeper due to depth of reserves, the applicability of the cross-pit conveyor is further limited.

Alternative methods

Before the decision was made to invest in a bucket wheel and shiftable belt system, Arch Mineral looked at various alternatives which could be applicable to the soil and depth conditions. At the Captain mine, any new material system would have to work as a continuous complement to the existing stripping machines. Arch personnel visited mines in several countries including West Germany, East Germany, Greece, Turkey, Yugoslavia, India and South Africa, to study the application of bucket wheels, shiftable conveyors, cross-pit conveyors and other systems and determine their suitability at the Captain mine from both operational and manpower requirements and economic scale.

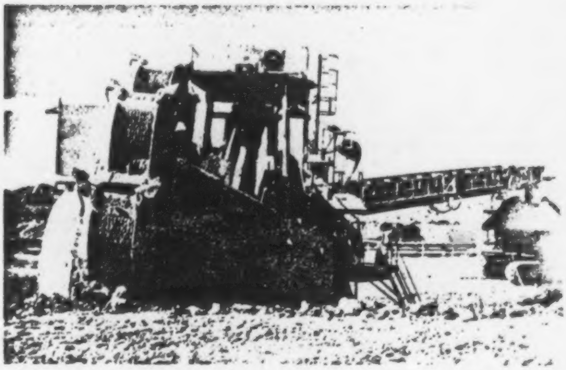
Alternatives considered included using the bucket wheel excavator ahead of the stripper and moving the unconsolidated material across the pit to the spoil side by shiftable conveyor, a cross-pit conveyor or an in-pit stacker. In addition, these systems were compared under mine conditions with conventional dozer-scraper material movement, selective handling by the dragline operator and continuous truck-shovel material haulage. Factors to be considered included total depth of overburden, depth of soft material, soil structure and reclamation goals including achieving contemporaneous reclamation, restoring row crop production and minimising compaction.

Ultimately, the shiftable conveyors were selected over the cross-pit conveyor or inpit stacker because they provide the opportunity to keep the bucket wheel excavator system far ahead of the main stripper, in this case the Marion 6360. Breakdown on any bucket wheel excavator system does not affect the stripper or blast-hole drills and there is enough space to lay out the high voltage electrical distribution system for all major equipment behind the bucket wheel excavator. The cross-pit conveyor and in-pit stacker have the additional disadvantage of being impaired if spoil or highwall slides occur.

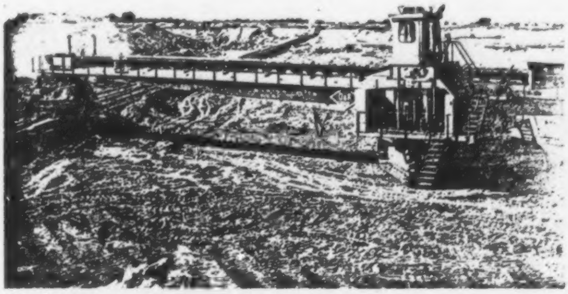
The capability of the bucket wheel system also depends primarily on reclamation goals, depth of soft overburden and hard overburden, the yardage capacity of the main stripper to provide equal rate of advance and the digging depth limit of the stripper as well. Having evaluated these factors for the entire mining area, the average capacity of the bucket wheel excavator was calculated. Sensitivity analyses to account for optimistic and pessimistic operating times were also completed to make sure the system would meet the reclamation goals. The capacity of other components in the bucket wheel excavator system, such as the beltwagon, shiftable conveyor flights and spreader, was based on the maximum theoretical capacity of the bucket wheel excavator, angle of repose of the material on the belt and the thixotropic property of the soft over burden.

A prototype system, consisting of an MX bucket wheel excavator, five Marathon conveyors and a RAHCO spreader, was purchased to provide on-site test application under the conditions existing at the mine. Two years of service by this equipment provided great enlightenment regarding seasonal performance, equipment coordination and capacities.

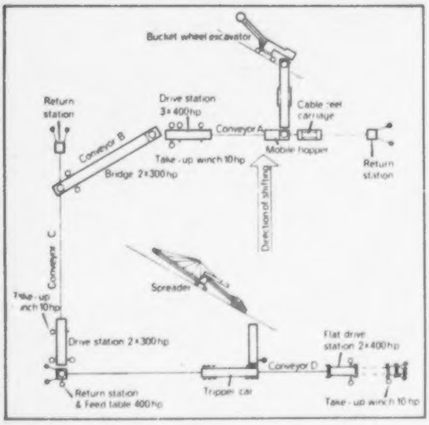
During the planning phase and even after the equipment was installed, special attention was given to performance of the system, particularly regarding the geological conditions and ground conditions during rainfalls. The high clay soil will severely inhibit performance of anything other than low ground pressure equipment when it is wet. A high ground pressure machine such as a scraper cannot operate efficiently under wet conditions. This proved to be one of the most important criteria in choosing the bucket wheel excavator over conventional material conveyance systems. Also operational aspects and manpower organisation were to be integrated into the existing



O&K bucket wheel excavator (above) digs out the upper layers of overburden.



An O&K beltwagon transfers material from the bucket wheel to the Weserhütte conveyor system.



Schematic diagram showing the arrangement of conveyors connecting the bucket wheel excavator to the spreader, relative to general direction of movement.

system at the Captain mine rather than just added.

The installed system

Arch Mineral's goal was (and continues to be) an overall improvement at the mine, not just one of an improved function at the cost of another function. The chief objective is an orderly optimisation of the systems as one integral function. Installed during 1979 and 1980, the new system at the Captain mine is developing this capability. Table 1 lists the O&K Weserhutte and Mitsubishi equipment currently in use.

The O&K Orenstein & Koppel SH630 bucket wheel excavator (BWE) is kept 600ft to 1,000ft ahead of the main stripper. The desired digging depth is controlled by a laser unit positioned behind the BWE. The excavator dischages the material onto a crawler-mounted O&K beltwagon, which transfers the material to the shiftable highwall conveyor through a travelling hopper made by Weserhutte. The beltwagon helps to reduce the shifting frequency of the conveyor and allows digging behind the conveyor in deeper soft overburden. The power to the BWE and beltwagon is supplied from a travelling cable reel car which is controlled by the beltwagon operator, who also controls the discharge conveyor.

The SH630 hydraulic bucket wheel excavator is the most recently developed in the O&K range of machines of this type. The first model, made at the O&K factory at Lübeck in West Germany, was dispatched in July 1977 to Yugoslavia and further machines were put into service in Spain in 1978. The excavators may be electrically or diesel engine powered: those at Arch Mineral are electrical. The hydraulic circuits allow the fluid to be diverted to the particular unit which demands the most energy, for example during digging power is diverted from the crawler drives to the bucket wheel and during travelling the reverse occurs. When the digging forces at the wheel periphery exceed a set value, the rotation speed and the slewing speeds automatically reduce. This increases the peripheral force as the length of bucket edge engaged in cutting is reduced, thus enabling the harder layers to be excavated without the need to disengage the wheel.

The material is transferred from the BWE onto an elevating conveyor which raises it from the highwall conveyor level to the side conveyor level, positioned up on the virgin ground. The purpose of the elevating conveyor is to reduce the ramp length and also reduce rehandle by the main stripper. The side conveyor carries the material to the spoil conveyor, which is positioned over the spoil approximately 200ft behind the last spoil peak to provide a slide-proof situation. The material is then transferred through a travelling tripper car to a discharge conveyor which, in turn, transfers it to the spreader which is crawler-mounted with low ground pressure. All the conveyors were designed and made by Weserhutte. The spreaders, manufactured by Mitsubishi, spread the material evenly over the spoil dumped by the main stripping machine. A low ground pressure bulldozer evens this material to allow the spreader to advance and position itself. The drive stations and elevating bridges are transported by self-propelled Weserhutte crawler vehicles. The whole conveyor system is electrically interlocked and is controlled from an operator at the spreader.

When the BWE digs the topsoil, the tripper discharge conveyor is slewed 180° to make a windrow behind the conveyor. After the conveyor is shifted, the topsoil is spread evenly by the low ground pressure dozer. The gradient of reclaimed land can easily be controlled to achieve approximately the original contour.

At the Captain mine, it was decided

Table 1: Bucket wheel systems at Captain mine

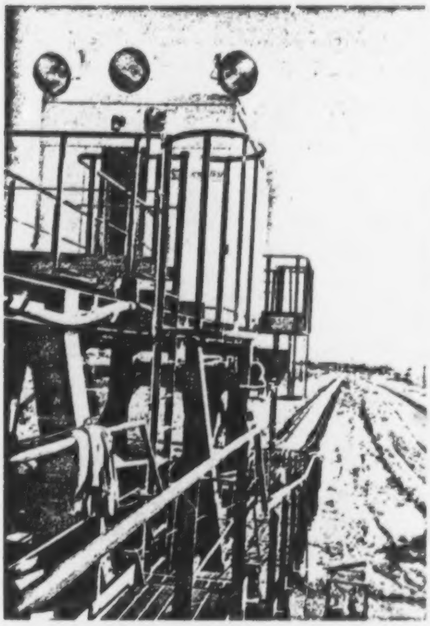
Component	Make	No.	Type	Capacity – Specification
Bucket wheel excavators	O&K	2	Electro-Hydraulic	Theo. 4060 yd³/h – Ladder Belt Length 50ft Av.-1,750 yd³/h – Discharge Belt Length – 81ft Bucket Capacity – 0.83yd³ Number of Buckets – 12 Maximum Cutting Ht = 50ft
Beltwagon	O&K	3	Electro-Hydraulic	Length = 131ft Belt Width = 54in Belt Speed = 826 ft/min
Highwall conveyor Travelling hopper car Travelling cable car	Wesserhutte	3	Head Drive Fixed Tension	Belt Width = 54in Belt Speed = 950 ft/min
Elevating conveyor	Wesserhutte	2	Head Drive Fixed Tension	Belt Width = 54in Belt Speed = 950 ft/min
Side conveyor	Wesserhutte	3	Head Drive Fixed Tension	Belt Width = 54in Belt Speed = 950 ft/min
Spoil conveyor Travelling tripper car Travelling tripper discharge conv. Travelling cable car	Wesserhutte	3	Head/Tail Drive Fixed Tension	Belt Width = 54in Belt Speed = 950 ft/min
Spreader	Mitsubishi	2	Electro-Hydraulic – Mechanical	Belt Width = 54in Belt Speed = 1050 ft/min Charge Conveor Length = 87ft Discharge Conveyor Length = 113ft
Transporter	Wesserhutte	2	Diesel-Hydraulic	

Table 2: Major equipment at Southwestern Illinois Coal Corporation

Captain Mine:
Marion 6360 stripping shovel with $180yd^3$ bucket
Harnischfeger P&H 5700 stripping shovel with $25yd^3$ bucket
Bucyrus-Erie 770B pull-back dragline with $20yd^3$ bucket
Bucyrus-Erie 2570 stripping dragline with $100yd^3$ bucket
Marion 5561 stripping shovel with $40yd^3$ bucket
Two Bucyrus-Erie 155-B loading shovels with $13yd^3$ buckets
Marion 151-M loading shovel with $11yd^3$ bucket
Marion 181-M loading shovel with $16yd^3$ bucket
Clark Lima 2400 dragline with $8yd^3$ bucket

Streamline Mine:
Marion 5761 stripping shovel with $60yd^3$ bucket
Page 752 pullback dragline with $42yd^3$ bucket
Marion 8200 stripping dragline with $62yd^3$ bucket
Marion 7200 dragline with $8yd^3$ bucket
Marion 111-M dragline with $4.5yd^3$ bucket
Marion 39-A dragline with $5yd^3$ bucket
Marion 181-M loading shovel with $12yd^3$ bucket
Marion 7200 dragline with $8yd^3$ bucket
O&K RH 75 hydraulic loader

Budgeted 1980 tonnages:
Captain Mine 4.816 million s. tons coal
Streamline mine 2.461 million s. tons coal



The new Weserhütte conveyor system at the Captain Mine carries top soil and sub-soil from the bucket wheels around the pit.

to cover the entire 6360 pit with two systems, one on each side of the centre haulage incline so that each system covers half of the pit. A study of two small bucket wheel excavator systems compared to one large bucket wheel excavator system indicated lower costs despite a doubling of manpower. Savings came primarily in capital costs. One large system would place severe constraints on coal haulage. Two smaller systems utilise standard machines which are simpler to maintain and have a good availability of spare parts.

So far, the experience with the bucket wheel excavator system has been very encouraging. The amount of material carried by the system continually increases and so does operating time. A learning curve for a radically different system was expected and further improvement will be forthcoming. Additional advantages have been noted, too: there are fewer slides and by reducing the depth of overburden to be handled by the main stripper, the yardage rate of the main stripper is improving due to better cycle time.

Other applications

Although for a long time the most productive means of access to the lower grade lignites in Europe, the bucket wheel is not likely completely to replace dragline and shovel overburden removal in the U.S.A. Entire towns and cities cannot be moved in the U.S.A. to gain access to the coal as is done in Germany and ownership patterns, zoning and expense in the U.S. prohibits this type of mining. There are few coal reserves in the U.S.A. which could logically implement both a conventional mode of stripping along with the bucket wheel system. Geological formations that do not have a large quantity of soft overburden superimposed on the coal cannot successfully utilise a bucket wheel system.

The utility of the bucket wheel, however, is enhanced by the regulatory format which requires that all land be put back in its general pre-mining stratification. Arch Mineral believes that soil structures, such as those found at the Captain mine, will actually be enhanced by breaking up the clay hardpan to provide greater agricultural productivity, freeing the nutritional content of the subsoil and otherwise restoring the land to a highly productive agricultural use. From a reclamation point of view, this is surely the most exciting prospect for the emergence of this new technology in the 1980's. Regardless of the actual comparative productivity of the soil, if agriculture plays a major role in the local economy, mining must be complementary to this aspect of the use of the land.

Arch Mineral goals

It is the goal of Arch Mineral Corporation to continue to harvest two crops from its lands, one for energy and the other for food. Southern Illinois will continue to demonstrate this dual land use pattern and it is not likely to be changed in the following years. The continuous need for coal to provide electric energy and the equally important need for intensive agricultural management mandates that all of these areas of Southern Illinois be planned with a regard for the totality of their land use capabilities.

The utilisation of this type of mining and reclamation system is therefore important for the future if large surface mines, operating in farming areas, are to continue to make good efforts to maintain the integrity of their coal recovery operation. The economic health of the industry is tied to good local relationships. As the policy has been set forth for this and as coal regains its importance as a primary fuel source for the growing U.S. energy needs, Arch Mineral believes that this type of bold, innovative technology will carry the surface coal mining industry successfully into the next century.

Acknowledgements

Mining Magazine wishes to thank the authors for preparing this article and Arch Mineral Corporation for arranging a visit to the Captain and Streamline Mines and for permission to publish this report. ■

Statement of
Illinois Farm Bureau

By
Richard Clemmons, Director, Local Government
Bloomington, Illinois

To
Energy, Nuclear Proliferation and Governmental Processes Subcommittee
U. S. Senate Committee on Governmental Affairs
Washington, DC

October 22, 1981

Our organization appreciates this opportunity to again provide testimony to this subcommittee regarding the subject of coal mining and its relationship to and impact on agriculture in Illinois.

This statement encompasses our policies, activities, and concerns regarding the implementation of P.L. 95-87, the Surface Mining Control and Reclamation Act of 1977, in our state. This testimony is presented on behalf of the membership of the Illinois Farm Bureau, a general farm organization with a membership of approximately three-fourths of the farmers in Illinois.

Surface mining obviously has had and will continue to have significant impact upon the agricultural communities in Illinois. We, as an organization, have long recognized that impact and have been actively involved in developing a strong state reclamation program to insure that the highly productive soils of Illinois are returned to a productive condition after they are surface mined.

The present policies of our organization reflect our desire for a strong surface mining reclamation program to preserve and protect Illinois' number one natural resource, our prime agricultural lands.

These policies, in part, state:

A. We will continue to work with private, state and federal agencies in the development and strict enforcement of sound regulations for the reclamation of mined lands that will give proper consideration to the needs and priorities of agriculture as well as energy and which will, to the extent possible, protect prime agricultural lands.

B. We will support state legislation to encourage preservation of appropriate lands for agriculture and open space uses through land use program which include a policy statement by all counties to:

   1. Preserve Class I and Class II farmland as defined by the Soil Conservation Service:

   2. Conserve Class III and IV farmland; and

   3. Protect all other classes of farmland from indiscriminate conversion to non-farm use.

C. We will support the development of a national energy policy to define the energy needs of the nation and how those needs can best be met consistent with the use of natural resources, protection of the environment, sound land use and the welfare of the people.

It should be noted in the policies above that our members try to strike a balance among obvious needs of our nation for energy and for food which happen to affect the same resource, the productive soils of Illinois.

We have long recognized the need to provide energy through domestic sources such as our abundant coal, but we believe that an equal need exists to protect our best, most highly productive farmlands for the food needs of the next generations.

The State of Illinois recongnized the need to start protecting and reclaiming good land with the passage of legislation in the early 60's requiring reclamation of surface mined lands. Subsequent laws in the decades of the 60's and 70's supported by the Illinois Farm Bureau provided stronger reclamation standards.

Today, state law in Illinois provides for reclamation for agricultural usage where the pre-mined activity was row-crop production.

Traditionally, our organization has relied heavily upon state, county and local governments to provide the necessary programs and assistance on issues which are a public concern. We believe that federal involvement is necessary at times in providing national policy and monetary assistance that cannot be provided at other governmental levels. Many times this includes research to determine answers to broad public policy issues.

In the instance of surface mining we consider the federal role to be appropriate in these above listed areas. Congress answered a national concern regarding the effect of surface and underground coal mining activity on prime farmland when it passed the 1977 Surface Mining Control and Reclamation Act.

We believe the most effective method for continuing the advancement of reclamation of surface mined lands is to allow, encourage, and assist states to develop and control the basic elements of the surface mining act. We believe programs are most effective when they are implemented by governments as close to the people as possible who understand the issues from an on-site perspective rather than through a federal program.

The Department of Interior Office of Surface Mining has recently indicated through various rule-making changes and deletions that federal involvement in implementing the provisions of the Act will be reduced and that the federal goal will be to transfer to the states the power to implement the law based on the state's circumstances and needs.

In order to retain the strength of the federal act as a minimum guideline for the states to follow, we feel certain issues should be addressed. They are as follows:

1. Stringency of State and Federal Laws:

Language in the Illinois law passed in 1980 which allows our state to assume the program of the federal act provides that our state program can be "no more stringent" than the federal act. (Illinois Revised Statutes, Chapter 96 1/2, Article I, Section 1.02 (c)).

The federal act (30 U.S.C. 1201, Title V, Section 505 (b)) requires that state statutes cannot be less stringent than the federal act.

Our concern is that language of the Illinois act will not allow our state to improve the program where needed or justified because no parameter exists to allow more stringent programs with the existing language in the state and federal statutes.

We will actively support an amendment in our state legislature to remove the "no more stringent" language and thus allow our state the needed flexibility to improve the reclamation program where it can be identified that unique situations warrant more stringent program requirements than those provided as federal guidelines.

2. Grandfathering:

We believe it was the intention of Congress that in a reasonable period of time all surface mining activity come under the requirements outlined in the federal act. Recently, the Department of Interior deleted from its rules the "grandfathering" date which would have required all mining operations to comply with the permanent regulatory program on August 3, 1982.

It is important that all states develop similarly stringent programs for compliance under this act. Without a grandfathering date in the program to insure that minimum reclamation will be made, states with signigicantly weaker programs, or an unwillingness to comply with the Congressional mandate may develop an economic advantage over states who do and at the same time not provide the needed reclamation of valuable land resources.

3. Proof of Productivity:

In 1975 Illinois' reclamation program provided for certain physical characteristics in its rules on reclaiming to row-crop agricultural productivity. The provision of P.L. 95-87 continued this one step further and provided that in order to prove acceptable reclamation of prime farmland we should grow crops on those lands using equivalent management to surrounding non-minned areas to determine if equivalent yields are achieved.

In recent rule-making by the Department of Interior regarding reclamation on prime farmlands and the productivity test, the equivalent language was removed. It is our feeling that this omission of "equivalent" actually circumvents the intention of Congress and should be re-inserted into the appropriate rules.

Growing crops are the ultimate test of the productivity of the soil. This test for reclamation should be retained as the standard for proof of sound reclamation on prime farmland.

4. Selective Mining:

We believe one of the intentions of Congress during the debate and passage of the 1977 Act was to encourage mining only where it was feasible to achieve reclamation without sacrificing another long-term resource such as the agricultural productivity of prime farmlands.

The Designation of Lands Unsuitable for Mining provisions of the federal act should be fully implemented and tested to insure that we do indeed mine only those areas where we can reclaim to equivalent productivity and that we do not mine areas such as prime farmlands when productivity tests for reclamation do not show equivalent results.

We are participating in research at the University of Illinois with the goal of developing new and improved methods of reclaiming farmland. Based on preliminary results, we believe this research may show that some of our rolling clay soils can be reclaimed to their original or even better productivity. However, it appears that we may not have answers yet on the reclamation of our class I and class II prime farmland. Thus, Mr. Chairman, we believe we need to concentrate our strip mining on land of lesser productivity than class I and class II prime land.

5. Surface Affects of Underground Mining:

Illinois' coal resources will be mined by underground methods in a vast majority of cases under today's technology. Some 87 percent of the recoverable coal in Illinois will be mined underground.

Even today, little is known about the surface damage done by subsidence of agricultural lands. We favor increased study and research into the impact of surface subsidence on agricultural productivity, its potential in the future, and means by which we can control or eliminate damage to agricultural productivity by subsidence. We stand ready and willing to assist in such studies.

Senator Percy, we commend you for your leadership in protecting prime farmland from indiscriminate strip mining. We commend you for your continued commitment to this principle. We stand willing to work with you to find the best possible answers to the problems challenging all of us in this regard.

The Illinois South Project, Inc.

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Statement of
Michael D. Schechtman

On Behalf of
The Illinois South Project, Inc.

Senate Hearing on
The Office of Surface Mining and
Protecting the Nation's Prime Farmlands

Subcommittee on Energy, Nuclear Proliferation
and Government Processes

Government Affairs Committee
United States Senate

October 22, 1981
Washington, D.C.

Illinois
South

Mr. Chairman and Members of the Subcommittee:

My name is Michael Schechtman, and I am a staff member of the Illinois South Project, Inc. of Herrin, Illinois. My testimony today is being given on behalf of the Illinois South Project, which is a not-for-profit research, education and advocacy organization that began in 1974 with seed money from the Illinois South Conference of the United Church of Christ. The Project employs 7 full-time staff members who work with individuals, communities, locally elected officials and organizations on natural resource issues throughout the State of Illinois.

Since the Project's inception, Illinois South has had a particular focus on addressing the impacts associated with the development and utilization of Illinois' vast coal resources, with twin goals of maximizing the local share of the economic benefits that coal development can bring, and minimizing the environmental degradation and social disruption that historically has been associated with the coal industry.

Although Illinois South Project is a strong advocate of local control, my organization has long supported the concept of a national surface mining act because of the inability of coal county residents in Illinois -- as well as other states -- to win the rights of basic protection of their property and communities and the breadth of environmental standards that ultimately were incorporated into Public Law 95-87, the Federal Surface Mining Control and Reclamation Act of 1977 (SMCRA).

As a matter of information for this Committee, I wish to point out that Illinois South Project favored passage of a national surface mining regulatory act since 1975; that Project staff had traveled to Washington, D.C. several times to lobby on behalf of passage of such legislation; that Project staff worked with other citizen, farming, environmental, and church organizations in Illinois to coordinate letter writing campaigns supporting passage of such legislation; and that since August of 1977, has had a major organizational program watchdogging the implementation of this Act and working with citizens and local public officials to assist them in making proper use of the new rights that had been won under the Act.

Illinois South Project wishes to express its appreciation to the Chairman and the Members of this Subcommittee for holding this hearing. Since January of this year, many allegations have been leveled regarding the health of the industry and how SMCRA has constrained coal production. Similarly, much has been said as to whether this Administration and Secretary Watt will or will not uphold the spirit and intent of the Congress as manifested through the enactment of P.L. 95-87. In light of the State of Illinois' crucial stake in this debate -- the fact that 65% of the State is underlain by coal resources and that Illinois has more prime farmland sitting on top of strippable coal reserves than any other State -- we particularly appreciate this Subcommittee's efforts to get behind all the posturing to find out what is actually happening in the nation's coalfields.

Constraints on Coal Production

Despite allegations that so-called "environmental extremism" has nearly brought energy development in the United States to a screeching halt, coal production nationally has been increasing steadily. Coal production for 1976, the year before SMCRA was signed into law, was 689 million tons (1977. Energy Information Administration). By 1980, coal production nationally had increased to 835 million tons (1981. U.S. Department of Energy), and according to the October, 1981 issue of Coal Age:

> "Coal production continutes to outperform the overall economy. In the week ending August 29, coal production reached a record level of 19.3 million tons and U.S. railroads hauled more coal than in any week since 1976. Conversely, the national economy has looked a bit sickly lately."

In Illinois, coal production also has increased since passage of the Federal Act. Coal production in 1976 was 58.1 million tons, and for 1980, total production reached some 62.5 million tons. Illinois South is not trying to suggest that everything is all roses with the coal industry; that is not the case. Some Illinois companies have lost contracts to utilities that have switched to low-sulfur western coal to meet clean air standards,* and some mines have closed, while others have reduced their workforce. Nevertheless, we can point to various surface mining operations in Illinois that have increased coal production dramatically since the implementation of SMCRA, with increases in annual production levels as detailed in Appendix A.

Although there clearly have been new cost increases as a result of the enactment of SMCRA and the implementation of the regulations promulgated under the Act, coal production figures for both Illinois and the nation demonstrate that broad sweeping statements that SMCRA is putting the coal industry out of business are not only misleading and erroneous, but grossly irresponsible.

The Prime Farmlands Controversy: The Illinois Context

While Illinois has more prime farmlands overlying strippable coal than any other state, it would be inaccurate to generalize that all prime farmlands in the State are of the same physical, chemical, and biological composition, and can be mined and reclaimed uniformly.

According to Ivan Jansen, assistant professor of pedology at the University of Illinois, and one of the foremost field researchers on prime farmland reclamation:

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*Illinois South Project fully supports the clean air standards and is not trying to suggest that switching to western coal was the only option available to the utilities. Some utilities chose using a mix of western coal and Illinois coal to meet the standards, and some decided to invest in scrubber systems as a financially viable way to both meet the standards and continue using high sulfur Illinois coal.

> "Approximately 60% of the land area in Illinois is prime farmland. Included are extensive areas having soils that are nearly ideal in physical and chemical properties for row crop production. Other soils are good enough to qualify as prime farmland but have undesirable features that cause management problems and limit productivity. Long term average corn yield expectations under high management on Illinois prime farmland soils (as defined in P.L. 95-87) range from about 1.05 kg/m^2 (167 bushels per acre) on the best soils to less than 0.6 kg/m^2 (96 bushels per acre) on less desirable soils (Fehrenbacher, et al, 1978).
>
> Mines operating on some of the best soils have a very high objective to achieve in trying to construct postmine soils that equal or exceed surrounding unmined soils in productivity. Since the undisturbed soils have nearly ideal properties, one does not have the opportunity to try correcting soil problems during the mining and reclamation process.
>
> By contrast, mines operating on prime farmland that have less productive soils will have a lower productivity objective to be achieved by their constructed soils. Constructed postmine soils having a corn yield capability of only 0.6 kg/m^2 (96 bushels per acre) will be acceptable under the "equivalent or higher levels of yield" provision for the federal Surface Mining Control and Reclamation Act if that is the yield capability of surrounding undisturbed prime farmland soils. Also, there may be an opportunity to ameliorate some undesirable features of these less than ideal soils. Hence there is a potential for positive effects from the soil disturbance and reconstruction process to offset negative effects." (Jansen, I.J. 1981. Reconstructing Soils After Surface Mining of Prime Agricultural Land. Mining Engineering, March, 1981.)

The "Corn Belt" region of Illinois that is commonly known for its rich, dark, deep prairie soils does not cover the length of the State. The Southern Illinois region -- the area with the highest coal production -- is a distinct area of the State which does not contain the prairie soils capable of the dramatic corn yields described by Jansen. The soils of Southern Illinois are much older geologically; they are much more weathered and have far less organic content and needed plant nutrients. A common feature associated with most prime farmland soils in Southern Illinois is a clay fragipan subsoil that lies beneath topsoil. This clay fragipan impedes the infiltration of rain and the movement of subsoil waters, as well as impedes the penetration of roots. Generally speaking, the C horizon below the clay fragipan contains more sand, less clay, and more nutrients vital to plant growth. Consequently, the mixing of these subsoils has the potential of ameliorating undesireable features, as suggested by Jansen; however, this soil condition just described as not typical of the prairie soils to the north. One cannot and should not assume that mining and reclamation results attained in southern Illinois can be directly generalized as applicable to the prime farmland prairie soils of central Illinois.

Actions and Policies of Secretary of Interior James Watt

There have been many actions and policy decisions since Interior Secretary Watt came to Washington in January that materially weaken the rules and regulatory framework that had been established to assure the highest possible standards for the protection of the nation's prime agricultural lands. There are two major areas of concern with respect to actions by the Secretary and by those he has brought to power within the Office of Surface Mining: (1) those actions which directly weaken existing regulations and enforcement capabilities; and (2) those actions which indicate acquiescence to state practices that were not acceptable to the previous administration, and in fact, were the kinds of practices which led Illinois citizens to lobby for a national surface mining act in the first place. Since in most cases these two kinds of actions overlap on any one particular topic area, the remainder of my testimony will be organized by topical headings.

Attainment of 100% of Pre-Mining Productivity

There is no other issue as critical to the proper implementation and enforcement of the prime farmland provisions of the Federal Act as the question of how coal operators will be allowed to demonstrate that they have reclaimed prime farmland "to equivalent levels of yield as nonmined land of the same soil type in the surrounding area under equivalent management practices" [§519(c)(2) of the Federal Act]. How productivity will be proven is still an unresolved matter within the Office of Surface Mining, and Illinois South Project requests that this Subcommittee closely monitor how OSM moves forward on this matter.

Illinois South Project's position is that only by growing crops -- and they should be the same crops as those commonly grown on non-mined prime farmland in the surrounding area -- can the productivity of mined soils that have been stripped, moved, manipulated and reconstructed be measured accurately. Any method of proving productivity that does not include growing crops on the reclaimed soils is an unacceptable substitute, and we hope that the Subcommittee will both agree with this position, and urge the Office of Surface Mining to adopt it.

The regulations that had been promulgated under the previous Administration contained requirements for growing crops as the appropriate way to test productivity levels for the reclaimed prime farmlands. Unfortunately, litigation brought those regulations into U.S. District Court for review, and Judge Thomas Flannery ruled that "...this capability can be demonstrated by a soil survey." Since Illinois South Project was convinced that the Judge was wrong on technical grounds, our attorneys appealed that ruling in addition to several others. When the Carter Administration filed its brief for appeal we were pleased to see that they too supported our position regarding the necessity of growing crops to demonstrate the level of productivity that had been attained.

Although we thought that this specific issue could be brought to a satisfactory resolution at the Appeals Court level, Secretary Watt's so-called "Regulatory Reform" program that has initiated a rewrite of the federal regulations on surface mining, has essentially frozen this litigation. Because of our concern that the current leadership in OSM may very well reverse itself on this critical issue, and instead may decide that a soil survey may be an acceptable way to prove productivity, we wish to provide the Subcommittee additional information on this issue to assist the Subcommittee in its efforts to question Secretary Watt and Director Harris, and assist these two gentlemen in following a proper course of action for carrying out Congressional intent for §519(c)(2).

The Illinois South Project, the U.S. Department of Agriculture, the previous Office of Surface Mining and the National Academy of Sciences all have publicly disagreed with Judge Flannery's ruling on technical grounds.

A soil survey is defined by the National Academy of Sciences (NAS) study entitled, Surface Mining: Soil, Coal and Society (NAS, 1981), as an "inventory of the soil resources of an area" which "provides a data base for the evaluation of soil capabilities and limitations." (NAS page 106-7) A soil survey alone cannot show productivity. After mining, "a new soil survey of the reclaimed area will identify the general characteristics of the reclaimed soils." (NAS page 111) Surveys using more intensive field and laboratory methods than current practices could provide early indicators of reclamation success. Yet, to obtain only a preliminary evaluation of the effects of mining, one needs to use this "information on physical and chemical properties of the soil, along with careful monitoring of actual productivity after reclamation of the sites." (NAS page 112)

Furthermore, in discussing how to evaluate "Post-Mine Productivity" and revegetation success, the National Academy report states there are "two basic approaches". (NAS page 112) The first is to specify levels of biomass production (through the use of a target yield system). The second is the use of an undisturbed reference area to compare productivity. No where does the NAS report state that productivity can be evaluated by merely a soil survey.

In fact, the NAS report clearly states that the present USDA scheme for soil taxonomy is inadequate:

> "Systematic regional characterization of mine spoils appear to be at too early a state to develop a comprehensive scheme for classifying mine spoils in the context of the USDA soil taxonomy. In particular, much more work needs to be done in coal regions in the West, Gulf Coast and Midwest." (page 111)

Literature to date shows that there is greater variability in minesoils than natural soils. See for instance Schafer, W.M. "Variability of Minesoils and Natural Soils in Southeastern Montana" (Soil Sci. Soc. Am. J. 43:6 November - December 1979). This study also showed that "Problems were encountered while attempting to classify soils according to Soil Taxonomy" (from Abstract).

The only place the NAS comes close to technically confirming Judge Flannery's ruling is in referring to a report which "suggests that it might be possible to identify a combination of optimum values or ranges of values for specific soil properties such as density, texture, permeability, pH, and exchange capacity. These values might serve as a standard by which to determine a soil's productive potential". (NAS Page 155) Also, such a soil survey would only serve to show productive potential, versus actual ability to reach equivalent levels of yield.

Another major concern of Illinois South Project is that the operator be required to employ the equivalent levels of management of the surrounding farmers. We ask that the Subcommittee make sure that OSM requires that management practices such as fertilization, type of equipment used and the extent of use of the equipment be similar to the practices of the area on a specific soil association. Most importantly, the OSM or the regulatory authority should not allow the operator to irrigate to achieve productivity requirements for bond release if irrigation is not a common practice of the farmers in the surrounding area.

OSM is in the process of drafting rules which will be used to prove productivity on prime farmland. It is critical that this Subcommittee monitor the promulgation of these rules to ensure that methodology is developed which accurately demonstrates that 100% of pre-mining productivity is reached.

The Grandfather Exemption

The Federal Act's expemption from meeting the full demonstration, reclamation and bond release requirements for prime farmland, commonly known as the grandfather clause [§510(d)(2)] has created more controversy than almost any other section of the Act. To date, the Office of Surface Mining has yet to adopt regulations that ensure that this grandfather exemption would be the exception, rather than the rule.

As a result of both litigation and the revised regulations adopted by OSM and printed in the Federal Register of September 29, 1981, there currently exists no cut-off date for ending the use of the grandfather clause. This Subcommittee should know, however, that the issue of a cut-off date was extensively debated in the Carter Administration and, after numerous rulemaking comment periods, the Carter Administration came out with a final rule setting August 3, 1982 as the end point for grandfathering. The final rule with the August 3, 1982 cut-off was issued in the Federal Register on January 23, 1981. Under the direction of Secretary Watt, the effective date of the rule was postponed numerous times and when finally re-issued on September 29, the Secretary had deleted the cut-off from the rule. The implications for the State of Illinois, with its long continuous coal seams, are absolutely staggering. As was stated in the General Accounting Office's August 5, 1981 report to Secretary Watt entitled "Comments on Interior's Surface Mining Regulations" (GOA Report), "Under the act, as interpreted by the U.S. Court of Appeals for the District of Columbia in May 1980, any mining operation with a permit approved before enactment of the act (grandfather clause) is excluded from the prime farmland provisions as long as the mining operation is the continued and contiguous operation of the same ongoing mine along its seam."

Illinois' major coal seams, No. 5 and No. 6, have been mapped by the Illinois State Geological Survey as being 42 or more inches thick throughout thousands and thousands of contiguous square miles within the State. Illinois surface mines have a history of longevity due to the nature of these continuous seams; in fact, the oldest operating surface mine in the State is over 50 years old. Despite the clarity of the intent of Congress to protect prime farmlands, the language of the grandfather clause in the Act necessitates having clear regulatory language to define a cut-off to end the use of the exemption. And without such language, thousands and thousands of acres of prime farmland in Illinois potentially could be grandfathered.

Furthermore, Illinois South Project agrees with the GAO Report that the exemption "...provides a competitive advantage to a grandfathered coal operator who will not have to comply with the more costly (prime farmland) regulations...". (GAO Report) There is nothing in the legislative history of the Act to indicate that the Congress had intended to give existing mine operators such an economic advantage over other operators for years and years following the Act's date of enactment.

Illinois South Project recommends that to carry out the Congressional intent of maximum protection for the nation's prime agricultural lands, OSM should move ahead as expeditiously as possible, and adopt a cut-off for the grandfather exemption effective 30 days following the notice in the Federal Register for all states that already have a permanent regulatory program in place; and for states still in the interim program, grandfathering would end 8 months following the approval of these states' permanent programs.

We can find no acceptable excuse for OSM's intransigence in moving forward on this issue. Both through rulemaking and through litigation, an incredibly extensive record has been built on this issue. OSM's continued delay in resolving the cut-off for the grandfather clause flies in the face of Congressional intent to protect prime farmlands. As stated in a letter co-signed by Senators Charles H. Percy, Nancy Landon Kassebaum, Alan J. Dixon, Paul E. Tsongas, Howard M. Metzenbaum and John Melcher that was sent to Andrew V. Bailey, then Acting Director of the Office of Surface Mining, delays in promulgating a cut-off date can only be interpreted "...as a lack of 'good faith' by the Department of the Interior." (Letter dated May 8, 1981).

There is one further point regarding the grandfather exemption which should be brought to the attention of this Subcommittee. OSM, IDMM and the coal operators have failed to use the interval during which the grandfather exemption has been in effect as an opportunity for coal operators to reclaim prime farmlands under the soils restoration scheme embodied in the Act [§515(b)(7)] and establish the state of the art technological capability without having to be concerned with being penalized if the performance requirements in §519(c)(2) were not fully met. Instead, operators, Illinois Department of Mines and Minerals (IDMM) and OSM used this opportunity to allow the reclamation of prime farmland to a lesser standard and most notably, mixing the B and C soil horizons. Thus, the operators failed to use the grandfather period to develop a much needed data base to show the technological capabilities both to mine prime farmland under §515(b)(7) standards and their ability to meet the performance bond release requirements of §519(c)(2).

In light of these problems, Illinois South Project urges this Subcommittee to get a commitment from OSM Director Harris of a target date in the very near future in which OSM will propose its regulation to end the grandfather exemption as well as a deadline by which time OSM will have adopted the regulation. Since Director Harris has stated publicly more than once that he believes that there should be a cut-off date for the grandfather exemption, Illinois South Project requests that the Subcommittee ask Director Harris whether the proposed cut-off suggested by Illinois South Project in this testimony is in line with his thinking, and if not, what is his thinking, and what is the basis or rationale he uses for some other cut-off date.

Demonstration of Technological Capability

Section 510(d)(1) of the Act requires that a permit to mine prime farmland can be granted only "if the regulatory authority finds in writing that the operator has the technological capability to restore such mined area, within a reasonable time, to equivalent or higher levels of yield as non-mined prime farmland in the surrounding area under equivalent levels of management..."

Congress' intent in passing this provision was very straight forward -- only if coal operators could demonstrate the technological capability to restore prime farmland to 100% of its pre-mining productivity, should they be allowed to mine the coal beneath. This approach was initiated by the coal industry as an alternative to a limited moratorium on coal mining on prime farmlands which was being advocated by the USDA and many others who lacked confidence in the ability of coal companies to fully reclaim prime farmland. We agreed that this approach seemed an acceptable compromise at the time, and it seemed to meet the needs and concerns of both the coal industry and the residents of Illinois' rural farming communities.

The critical issue in this demonstration process -- one which OSM has and continues to refuse to resolve -- is what type of information is necessary to demonstrate technological capability. Illinois South Project believes that Senator Percy and the U.S. Congress visualized the demonstration determination to be based on sound data developed from field research on similar prime farmland soils, i.e., physical proof of equivalent yields. Unfortunately, such a data base has not been built in Illinois.

In the same article by Ivan Jansen that was quoted earlier in this testimony, Jansen summarized the Illinois experience in growing row crops on prime farmland as follows:

> "Row crops such as corn and soybeans are being successfully grown on reclaimed lands, but yields are commonly lower than on nearby undisturbed lands."

In a recent telephone conversation between Illinois South Project and Dr. Jansen, he stated that he knew of no published reports anywhere that document prime farmlands of the calibre found in central Illinois as having been mined and reclaimed to 100% of pre-mining productivity under equivalent levels of management. Therefore, one can only conclude that there remains a serious lack of published, verified field data that demonstrate the technological capability of coal operators to restore prime farmlands of the calibre found in central Illinois to 100% of pre-mining productivity.

Because of OSM's failure to grapple with this issue, coal companies in Illinois have been able to make this demonstration based on unacceptable information. Freeman United Coal Company's Industry Mine provides a useful example. Freeman United's west central Illinois mine -- Illinois' first major prime farmland permit application -- was required to prove technological capability.

The Illinois regulatory authority granted the permit based on the word of "experts", a few field plots which had not recorded management practices data to substantiate how yields were achieved, and some preliminary data from some southern Illinois test plots. Furthermore, these "experts" were coal company employees or employees of the Illinois Department of Mines and Minerals, and gave their opinions without having sound field data on central Illinois soils to substantiate their claims.

Unfortunately, coal operators have not used the time allowed by the State of Illinois' interpretation of the grandfather exemption (5 years) to do the necessary field research to demonstrate technological capability to reclaim prime farmland to 100% of its pre-mining productivity.

It is the opinion of Illinois South Project that this Subcommittee should instruct OSM to develop clear, technologically sound, field research data based criteria which will be used by the regulatory authority in evaluating whether a coal operator has the technological capability in a site specific instance to reclaim land to 100% of its pre-mining productivity. Furthermore, the USDA should be required to play a very active role in developing these criteria.

Alternative Post Mining Land Use

Another issue of key concern to Illinois South Project are the plans by the IDMM and the OSM to change the regulations regarding alternative post mining land use variances. Under the present plans of IDMM, which recently have been deemed adequate by OSM, the Department plans to use the alternative post mining land use provisions found in 30 CFR 816.133 to provide discretionary power to override the performance standards found in §515 of the Act. The Department's track record in the federal courts fighting the prime farmland regulations and before the Supreme Court against the prime farmland provisions of the Act indicates quite clearly that the Department hopes to use §816.133 to allow for variances from the prime farmland requirements of §515(b)(7) (soil segregation requirements) and §515(b)(3) (approximate original contour) and allow prime farmland to be mined and returned to other uses such as water impoundments.

In its draft rules for changing 30 CFR 816.133, OSM says the intent of the changes is to "facilitate...reclamation that takes advantage of unique development opportunities provided by surface mining operations." The creation of a lake where prime farmland once existed cannot be allowed to be considered "a unique development opportunity". The Act clearly states that prime farmland must be returned to prime farmland and that there can be no variance from this requirement. This was upheld by the Supreme Court in Hodel v. Indiana. Moreover, the regulations of the previous Administration requiring prime farmland to be returned to cropland were upheld in U.S. District Court by Judge Flannery.

Illinois Department of Mines and Minerals argued this issue before Judge Flannery and they lost. They submitted an AMICUS brief to the Supreme Court against this requirement and thev lost. So now they have turned to a new Administration that is hell-bent on granting Illinois primacy and Illinois has been told that its program, which allows such an illegal post mining land use, is approvable (Steve Griles letter to Doug Downing of September 16, 1981). Furthermore, the State has told OSM it is "delighted" with the draft rule quoted above, considering it "a long overdue, refreshing action." (Letter of 7/16/81).

In light of Illinois' never say die mentality and OSM' apparent permissiveness to allow prime farmland to be reclaimed to other uses, Illinois South Project would like the Subcommittee to get a firm commitment from OSM that they will never allow a state to grant a prime farmland permit with a reclamation plan that fails to return all the pre-mining prime farmland acres back to prime farmland. And as noted later in this testimony, this means that OSM must commit to this Subcommittee that they will not use the

Experimental Practices Section of the Act (§711) to allow such a deviation from this vital requirement.

Experimental Practices: Section 711 of the Act and Section 785.13 of the Permanent Regulations

Illinois South Project is very concerned that the "Experimental Practices" provision of the Act and regulations will be used by Secretary Watt and Director Harris to bypass the strong environmental protection and postmining land use provisions of the Act -- especially in the area of prime farmlands reclamation.

Our concerns are well documented in written policy and communications by the Office of Surface Mining. For example, on page 11 of an OSM document entitled, Schedule for Regulatory Reform, OSM officials recommended utilizing "experimental practices to provide immediate relief from onerous requirements in the Act and regulations." (Emp. added)

OSM has already begun putting this policy into practice in Illinois. In a June 3, 1981 letter to OSM from the State of Illinois regarding Illinois' permanent program re-submittal, Illinois asked whether "the Act in Section 515(b)(2) should enable states to vary land use requirements such as approximate original contour and prime farmland on a case by case basis". (Emphasis added). OSM's response in a letter of June 26, 1981 said, "We are in the process of reviewing this issue as a result of the recent Supreme Court ruling. Of course, Section 711 of SMCRA does provide for departures in individual cases on an experimental basis from the environmental protection performance standards promulgated under Section 515 and 516 of the Act."

Congress had no intention of creating a convenient loophole for coal operators under the guise, or should I say, disguise of experimental practices. The Senate Report (95-218 at 101) clearly documents Congress' intent: "The Committee was adamant that there should be no broad exemptions to the vital mining and reclamation standards of this bill. To provide unlimited exceptions would render the bill meaningless, since it would then be likely that the exceptions would become the rule."

> The experimental practice provisions will not only be used to by-pass the soil handling and storage protections and replacement requirements, but most importantly will enable the operator to reclaim prime farmland to other, less productive land uses such as water impoundments, wildlife habitat, or commercial development.

Illinois South Project adamently agrees with the Congress, the U.S. Supreme Court and the U.S. Federal District Court that the Federal Surface Mining Act recognizes prime farmland as a valuable and irreplaceable resource. The highest and best use of prime farmland is cropland, and all prime farmland must be returned to its pre-mining productivity. There are no provisions in the Act which suggest that prime farmland could be reclaimed to any other use or level of productivity.

Judge Flannery of the United States District Court for the District of Columbia, stated very clearly in his May 16, 1980 decision regarding the Permanent Surface Mining Regulations Litigation that, "These statutory sections demonstrate clear Congressional intent to restore prime farmland to cropland."

The U.S. Supreme Court's decision in Hodel v. Indiana regarding the question of constitutionality of P.L. 95-87 stated, "Similarly, Congress presumably concluded that allowing variances from prime farmland provisions would undermine the effort to preserve the productivity of such lands. In our view, Congress acted rationally in drawing these distinctions, and the fact that a particular State has more of one kind of mining operation than another does not establish impermissible discrimination under the Fifth Amendment's Due Process Clause."

The documentation presented in my testimony clearly illustrates that OSM has much bigger plans for the Experimental Practices section of the Act than merely a "means to invent the better mousetrap." (OSM Director Harris' response to questions at the September 22, 1981 House Oversight Hearing.)

Illinois South Project recommends that this Subcommittee should indicate, in no uncertain terms, to Secretary Watt and Director Harris that OSM must obey the decisions and actions of the U.S. Congress and the Federal Courts. The Experimental Practices provision of the Act and regulations should not be used to circumvent the requirements of the Act and regulations. And most importantly, this provision should not be used to weaken the Act's requirement that prime farmland be reclaimed to 100% of its pre-mining productivity, by allowing experimental practice exemptions which will let operators reclaim prime farmland to a less productive standard and/or use.

Regulatory Reform

Secretary Watt's plan for so-called "Regulatory Reform" also is of great concern to Illinois South Project. As members of the Subcommittee have most likely heard, the Secretary has pledged to remove what he calls "excessive, burdensome and counterproductive" regulations, as well as approve all state programs by early 1982. To change the regulations found in the permanent regulatory program is a time consuming process that will extend well into 1982, and quite probably well into 1983 in light of the litigation that has followed every step of regulation writing under this Act. Because of the requirement that states must base their permanent regulatory program on both the federal Act and the federal regulations, the Secretary is quickly running into a problem with his plan to grant states primacy in the very near future.

Secretary Watt has developed a "quick fix" to allow him to meet his goals of regulatory reform that is every bit as defiant of Congressional intent as using experimental practices to relieve coal operators from having to meet requirements of the Act. Secretary Watt's quick fix was to revise the standards for approving state programs so that recalcitrant states such as Illinois will be able to obtain primacy with regulations that do not meet the standards of the existing federal regulations.

The Secretary proposed a patently illegal standard known as the State Window for approving alternative state regulations that vary from the federal regulations, and consequently provide a means for the approval of very weak state programs. The comment period on this regulatory change has closed, and I do not seek to influence the outcome of the rulemaking through my testimony today. Illinois South Project's intention is to bring to the attention of this Subcommittee this potential area for significant weakening of prime farmland provisions within State programs as well as certain broader possible consequences that could result from the Secretary's quick fix approach.

If the Secretary's new State Window standard is determined to be illegal by the U.S. District Court for the District of Columbia, any actions taken by the Secretary based on the State Window standard will be null and void. Since such a decision will come after the Secretary has completed his first goal of granting all the states primacy by early 1982, the court's ruling invalidating the standard for approval will in turn invalidate all the state programs that had been approved through the use of this State Window. Not only will the country's surface mining regulations be thrown into limbo, but such a ruling coupled with the Secretary's massive reorganization plan and reduction in force certainly raises serious questions regarding the ability of the Department to adequately respond to a successful court challenge to his new standard for approval.

There remain additional issues of concern regarding the protection of prime farmland under the provisions of SMCRA. The courts remanded some of the regulations regarding the surface effects on prime farmland from underground mines; however, OSM has yet to come forward with proposed language. The planned reorganization of OSM and the scheduled elimination of OSM's regional offices raise serious concerns regarding OSM capability to do proper oversight. Subsidence impacts upon farmland are a very significant concern in Illinois; however, the regulatory reform process that in many cases has generated much weaker regulations causes us great anxiety. Rather than prolong what has already become rather lengthy testimony, I will instead invite the members of the Subcommittee to come to Illinois and hold a field hearing on all of these issues in much greater depth. The many Illinoisans with whom we work who very much wanted to be part of this hearing, but could not, would be most appreciative if such a field hearing were held.

Thank you for the opportunity to present this testimony.

APPENDIX A

COAL PRODUCTION OF SELECTED ILLINOIS COAL SURFACE MINES: 1976 AND 1980

Coal Company	Mine	1976 Tons of Production	1980 Tons of Production	Increase
AMAX Coal Co.	Sunspot Mine	743,524	1,265,034	521,510
AMAX Coal Co.	Delta Mine	731,056	2,137,292	1,406,236
Consolidation Coal Co.	Burning Star #2	1,283,896	1,897,830	613,934
Consolidation Coal Co.	Burning Star #3	955,074	1,098,048	142,974
Consolidation Coal Co.	Burning Star #5	434,850	2,215,218	1,780,368
Freeman United Coal Mining Co.	Fidelity Mine	1,091,773	1,285,900	194,127
Peabody Coal Co.	River King #3	448,825	856,890	408,065
Southwestern Illinois Coal Corp.	Captain Mine	3,537,959	3,610,869	72,910
Southwestern Illinois Coal Corp.	Streamline Mine	1,451,566	1,845,183	393,617
		10,678,523	[illegible]	5,533,741

NOTES:

(1) AMAX's Delta Mine added a new pit subsequent to 1976, which accounted for most of the production increase at the mine.

(2) Consolidation's Burning Star #5 began producing coal in 1976, and it took several years for the mine to reach full production.

(3) During the 1976 - 1980 interval, there were Illinois surface mines that had reductions in the level of coal produced annually. These mines were selected to provide clear documentation that surface mines in Illinois increased their level of coal production in many cases, and that sweeping generalizations which either state directly or imply indirectly that the Federal Surface Mining Control and Reclamation Act of 1977 has hurt the production of coal from Illinois' surface mines are inaccurate and misleading.

Source of Data: Illinois Department of Mines and Minerals

Chart Prepared by: Illinois South Project, Inc. October, 1981

IN THE UNITED STATES SENATE

COMMITTEE ON

GOVERNMENTAL AFFAIRS

* * * *

SUBCOMMITTEE ON ENERGY, NUCLEAR

PROLIFERATION AND GOVERNMENT

PROCESSES

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STATEMENT OF THE ILLINOIS DEPARTMENT OF MINES AND MINERALS

Bradley Evilsizer, Director

Douglas M. Downing
Supervisor, Division of Land Reclamation

October 22, 1981

The Illinois Department of Mines and Minerals is pleased to have an opportunity to address this Subcommittee on the subject of implementation of the federal Surface Mining Act (the "Act") regarding prime farmlands. The Chairman, Senator Percy, knows firsthand that Illinois is the state most blessed with abundant resources of prime agricultural land, as well as significant coal reserves.

Even before the federal Act became law, Illinois had embarked on a regulatory program to assure that its cropland would be preserved for optimum productivity after mining. It is well known in the industry and among the draftsmen of the Federal Act that Illinois' state rules served as a model for the key prime farmland handling provisions of the federal Act. We have spent the last four years working to assure the proper implementation of the Act.

The subject of prime farmland protection is not only important; it is often tinged with emotion. There are a number of technical issues that exist concerning the Act and good reclamation technique. It is the Department's philosophy to base its decisions on technical understanding, and to seek to learn and develop information concerning farmland reclamation. We intend to assure that good reclamation occurs in compliance with the law, so that Illinois can remain a strong agricultural state, while developing its coal reserves. This statement summarizes regional and Illinois resources of prime farmlands and coal, and highlights specific issues concerning the Act and its administration.

I.

PRIME FARMLANDS AND COAL MINING

A. The Resources of the Corn Belt Generally

A recent study of prime farmland disturbance from coal surface mining in the Corn Belt states of Illinois, Indiana, Iowa, Missouri, and Ohio, prepared by Argonne National Laboratory for the U. S. Government, summarizes the status of agricultural and coal resources in these Corn Belt states, and related reclamation issues.[/]

As a result of its fertile soils and continental climate, the Corn Belt is probably the single most productive agricultural region recognized by the U.S. Department of Agriculture and ranks among the world's outstanding grain-producing regions, yielding large quantities of food and feed grains, oilseed, livestock, hay, and other agricultural products. The five states which make up the Corn Belt contain some 165 million acres of land, 77 million acres of prime farmland, and 110 billion tons of mineable coal reserves. Nationally, this represents 7% of the total land area, 22% of prime farmland, and 25% of mineable coal reserves. In 1976, there were about 35 million persons in the Corn Belt, of whom 2.5% were employed in agriculture, and 0.2% worked in the mining industry. Each year the Corn Belt produces about 25% of the nation's agricultural output, and about 20% of the nation's coal.

[/] The subsequent paragraphs of this statement summarizing Corn Belt regional agriculture and coal resources (Part A hereof) are, in large part, extracted and edited from "Prime Farmland Disturbance From Coal Surface Mining In The Corn Belt, 1980-2000" by David P. Bernard, Argonne, National Laboratory, Argonne, Illinois, a study prepared for the U.S. Department of Energy Under Contract W-31-109-ENG-38.

i) Agricultural Land Capability And Prime Farmland

Nearly three-quarters of the Corn Belt land is grouped in the top three land capability classes recognized by the Soil Conservation Service. According to the SCS classification, soils can be ranked according to the amount of management required for crop production on each soil type (Dideriksen et al., 1977). Class I soils have few limitations restricting their use for any type of agriculture. Class II and III soils have limitations that reduce the choice of plants which can grow on them and require conservation practices to sustain their value for producing agricultural crops. Soils grouped into Class IV are considered borderline for agricultural use because they have very severe limitations that reduce the choice of plants which can be grown on them and because in addition, they may require very careful management practices. Soils in Classes V through VIII are either altogether unsuitable for agriculture, or their utility is restricted to pasture, range, woodland, or wildlife-habitat uses.

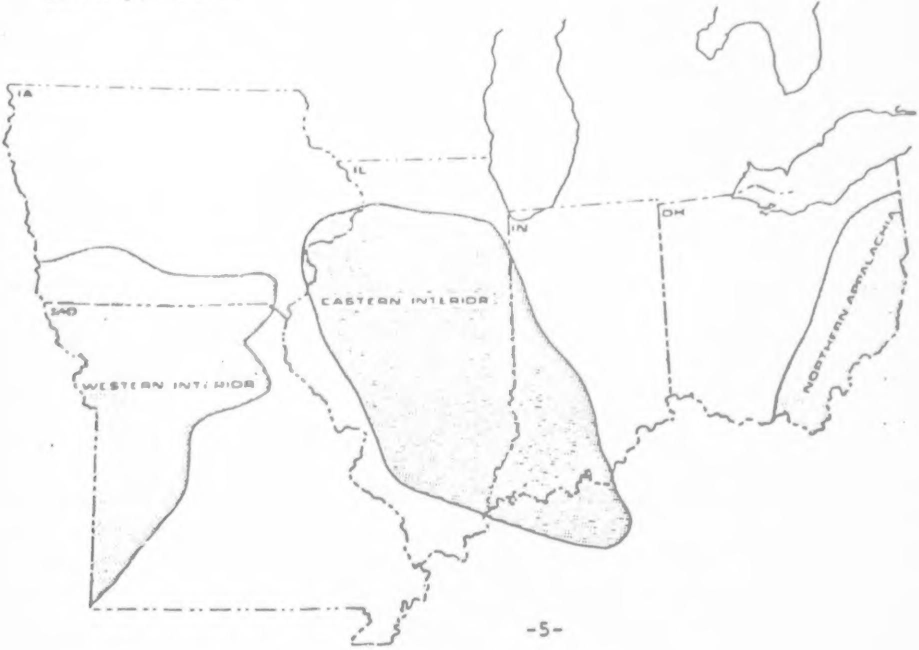
Prime farmland (according to the SCS definition) includes all Class I soils, more than 80% of Class II soils, and less than a third of Class III soils (Schmude, 1977). With proper management, there are about 110 million acres of arable land (Classes I through III) in the Corn Belt, and 39 million additional acres in Classes IV through VIII which, although not in urban or water uses, are unsuitable for producing crops. Recent studies have indicated that 76.8 million acres or nearly 50% of the land in the Corn Belt is prime farmland; this is the largest amount of prime farmland of the ten agricultural regions in the nation. All the Corn Belt states have prime farmland acreages exceeding 10 million acres. This vast amount of prime land is one of the key factors which have helped elevate the Corn Belt to a position among the world's most productive agricultural regions. In fact, over 70% of the land used for crop production in this part of the country is prime farmland (based upon data in Schmude, 1977).

ii) Coal Industry In The Corn Belt

All five states in the Corn Belt contain mineable coal deposits. The Interior Coal Region underlies portions of the Corn Belt and is composed of two provinces: the Eastern Interior Province which is aligned in a northwest-southeast direction under central Illinois and southwestern Indiana, and the Western Interior Coal Province which is oriented north-south, and underlies southern Iowa, northwestern Missouri, and parts of surrounding states. Additionally, part of the Northern Appalachian Province is found in eastern Ohio. In all, there are about 110 billion tons of coal in the Corn Belt, of which 19% is surface mineable.

The Eastern Interior Coal Region consists of coal fields in Illinois, southwestern Indiana, and western Kentucky. The coal is of Pennsylvanian age, is primarily bituminous in quality, and often has large amounts of sulfur present, although the sulfur content ranges from as low as 0.5% to 6.0% (U.S. Energy Res. Dev. Admin., 1977). Geologically, the coal is in a basin formation so that most of the reserves in central Illinois are too deep for surface mining. Consequently, surface mining activities in this coal region are confined to the perimeter of the basin where the coal is near the surface.

The Western Interior Coal Region is found in southcentral Iowa, north-western Missouri, and parts of Kansas, Arkansas, and Oklahoma. Most of the coal in this region is found in thin seams, and commercial mining is confined to strip-mining outcrops of the high-sulfur (less than 2%) reserves. See Map, below.



Despite the high production of coal in this region, all Corn Belt states, including Illinois, import coal. The leading use of coal in each state is for electric power generation, although in Indiana and Ohio, large amounts are used in other industries. In 1972, over one-quarter of the total energy consumed in the Corn Belt states came from coal, with Ohio using the largest amount (37%) and Iowa the smallest (18%) (Drysdale and Calef, 1977). With these factors in mind, it seems plausible that the Corn Belt coal industry will continue to supply a substantial portion of the region's annual coal demand.

Strippable Coal Reserves In The Corn Belt[a]

	Strippable Reserves (10^9 tons)		
State/Region	Total	Beneath Prime Farmland	Strippable Reserve Impact (%)
Illinois	12.2	6.5	53
Indiana	1.7	0.8	46
Iowa	NA	NA	NA
Missouri	3.4	1.2	36
Ohio	3.6	0.5	13
Corn Belt total	21.0	9.0	46
U.S. total	129.4	22.4	17

[a] Data from Harper and Anderson (1979).

NA = not available.

iii) Coal Production

During the past 15 years, coal production in the Corn Belt has, on the average, been increasing at the rate of about 3% per annum. This is a faster rate of growth than the national coal industry exhibited during the same period when the average growth rate was just slightly over 2% per year. In 1975, the total regional coal production was about 138 million tons, 65% of which came from surface mines; there were 433 surface mines and 58 deep mines in operation, employing about 30,000 miners.

There are several factors which help explain the predominance of surface mines in the Corn Belt. First, surface mines are often more productive with few employees; the average daily output per worker is considerably higher in a surface mining operation than in deep mines. In fact, on a national level, surface mines are more than twice as productive as their deep mining counterparts. During 1975, surface miners in the Corn Belt produced an average of 21.6 tons of coal per day per worker; each deep miner in the region produced 19.6 tons per day. However, in Ohio, deep mines had a better productivity record than surface mines in 1975, primarily because these mines were of the contour type.

A second major reason for the predominance of surface mining is that it is more efficient at removing coal from the seam. Surface mining methods on the average remove from 80 to 90% of the coal, in comparison to 45 to 50% in deep mining operations. Losses in surface mining are due mainly to spillage and losses in transit, whereas in deep mines (excluding the new longwell mining operations) much coal is left behind in columns and pillars.

iv) Regional Summary

1. The Corn Belt contains about 110 billion tons of coal reserves, 19% of which are surface mineable.

2. There are about 110 million acres of arable land in the Corn Belt, 69% of which are prime farmland.

3. Thirty-five million people live in the Corn Belt; over 30,000 work in the coal industry, and there are at least 875,000 farmers.

4. In 1975, 21% of the total coal produced in the nation was mined in the Corn Belt states, and over 50% of the nation's corn and soybean harvest was grown there.

5. By 1971, at least 920,000 acres of land had been disturbed by previous mining in the Corn Belt; the majority of the acreage could be attributed to coal mining operations.

6. As of 1975, there were about 13 million acres of Corn Belt land devoted to special non-farm uses, much of it in irreversible land uses such as urban developments, reservoirs, and roadways.

7. Current federal and state laws pertaining to surface mining require reclamation, including topsoil replacement, of disturbed lands; although routine reclamation practice has not yet demonstrated restoration of original soil productivity on large tracts of reclaimed prime farmlands disrupted by surface mining, there are positive research results. The federal regulations are too new for definitive data to be available; since the regulations are based upon state-of-the-art reclamation technology there is reason to believe the lands could be restored to their original levels of productivity as early as 10-15 years after mining.

8. Estimates of the potential land disruptions in the Corn Belt which could accompany future coal surface mining at the levels called for in the National Energy Plan show that 452,000 acres of land could be disturbed in the period 1980 to 2000, which is equivalent to 0.3% of the total regional land area.

9. It is estimated that, at the levels of coal extraction called for in the National Energy Plan, 127,000 acres of prime farmland in the Corn Belt could be disturbed in the 20-year period 1980 to 2000, which is equivalent to 0.2% of the total regional prime farmland area.

10. Certain counties in the Corn Belt may experience greater impacts from disturbance of land and prime farmland than the regional averages would suggest: examples include Perry County in Illinois; Pike and Warrick counties in Indiana; Henry County in Missouri; and Belmont, Harrison, and Jefferson counties in Ohio.

B. ILLINOIS COAL PROGRAM IN PERSPECTIVE

Illinois ranks third in the nation in number of acres of prime farmlands and contains an abundance of proven recoverable bituminous coal reserves. Illinois' policy, law and regulation is dedicated now, as it was prior to enactment of the federal Act to the maximization of the benefits of these resources and the minimization of harm to its citizenry from their use.

Illinois, itself contains an estimated 23.8 million acres of prime farmland and other farmland which is used to produce rowcrops. Approximately the southern two-thirds of Illinois is underlain by bituminous coal reserves; Illinois contains approximately twenty-five percent of the nation's bituminous coal reserves. The total of estimated coal reserves in Illinois is 162 billion tons of which 30 billion tons, or roughly 1/8 of the nation's total recoverable coal reserves of all types, is recoverable under present technology. Of this 30 billion tons, about 30-40% is mineable by surface mining methods and the rest are mineable by underground mining methods. Prime farmlands cover at least 50 to 60% of the coal reserves in the state, and are interspersed so as to cover for practical regulatory purposes part of almost all mines covered by the Act.

In Illinois, almost 100,000 acres of rowcrop capable farmland are taken out of production annually, not including the 5,000 or 6,000 acres used temporarily for surface coal mining. In many communities in Illinois, there is no practicable choice of another type of land to be affected by expansion of communities and public roads and facilities.

Illinois has regulated coal mining since 1874, and the reclamation of surface coal mines since 1962. It has issued mining permits and required compliance with stringent farmland reclamation requirements since prior to passage of the Federal Act. Illinois Surface-Mined Land Conservation and Reclamation Act Rules and Regulations, Rule 1104. State regulation of coal mining is comprehensive. See Ill. Rev. Stats. (1979), Ch. 96 1/2 SS 2551 et. seq., 4001, 4101, 4401, 4501, et. seq., 7901 et. seq.

At this time, roughly two thousand miners are out of work in the Illinois coal fields, while another 400-600 are working short work weeks. Many more jobs are indirectly affected. In the past two years, five large Illinois coal mines have closed. At least two of these closures are relatable in part to the implementation of the prime farmlands provisions of the Act.

Only some 5,000-6,000 acres of Illinois lands are newly mined annually. All of this acreage is subject to prompt, strict reclamation under state (and now, federal) law. By contrast, in 1979, some 327,000 Illinois farmland acres (not all "prime") were in voluntary "set aside" programs. The Federal government paid the owners of those lands more than $7 million not to grow crops. Even if Illinois' annual mined acreage were to double overnight, it still would require some 32 years to mine the land in Illinois set aside deliberately in 1979 to alleviate low prices in the farm commodities markets. In fact, lands mined in Illinois are restored to their optimal use, and all rowcrop quality lands (both "prime" and nonprime) must be restored to rowcrop capability under Illinois law. Appendix A is an excerpt of relevant provisions of Illinois law in effect since 1975, well before the passage of the federal Act. Ill.Rev.Stat. (1979), Ch. 96 1/2, par. 4507.

Because of the large size of Illinois' coal reserves and other reserves underlying Indiana and Western Kentucky, one practical effect of allowing the Interior Department to prescribe land use controls that help keep this coal from the marketplace is to tend to give to the Interior Department monopoly power over coal resources. Much of the coal mined in the West is coal from federal lands or lands located such that federal lease rights control its being mined. Thus, without paying for the nation's largest energy supply, the federal government, by land use control in the Middle West and East, can effectively see to the maximization of federal profit from coal development. Thus proper implementation of prime land rules is essential to Illinois' future.

Illinois as a matter of state policy is committed to a longterm effort to secure and protect its natural bounty of prime farmlands against irreversible loss or degradation. Attached as Appendix B, is an Executive Order of Illinois' Governor, dated July 22, 1980, which confirms the policy of the State "to protect, through the administration of its current programs and regulations, the state's prime agricultural land from irreversible conversion to uses which result in its loss as an environmental or essential food production resource". In an official statement at a federal public hearing on the Illinois "permanent program" submittal, the Illinois Department of Mines and Minerals declared, in effect, that if court action or other events result in a federal scheme of regulation less than adequate to protect Illinois' agricultural resources, it is prepared to work to assure such protection. Finally in Appendix C, there is reprinted a recent statement of Illinois' intent to protect prime farmland and other lands well suited to producing crops, as embodied in Rule 1104 (a Rule promulgated prior to the enactment of the Federal Act) which appeared in the August 20, 1980 Congressional Record at page S11279.

Careful examination shows that in Illinois' mining counties, one million more acres of rowcrop lands are required, if mined, to be restored to their row-cropping capability than the Federal Act requires respecting prime farmlands. Thus Illinois assures greater total post-mining agricultural productive capacity than that required by the Act, and this occurs by methods developed by experts costing significantly less per ton of coal than the horizon by horizon approach which some people have regarded as the preferred "federal" method.

Before the Act became law, Illinois was already strictly regulating surface mining within its borders. Among the most progressive of its regulations was Rule 1104, adopted in 1976, which prescribes topsoil removal, plus detailed requirements for a minimum 48 inches of root medium depth and texture of reclaimed land which was capable of growing rowcrops prior to its being mined. These requirements were developed by soils scientists with the particular goal of assuring adequate water holding capacity in the reclaimed soil to support rowcrops. They will continue to assure high quality immediate reclamation of coal mined lands.

We would like to emphasize that use of the Rule 1104 soil mixing technique is consistent with the prime farmland provision of the Federal Act.

II.

SOME CURRENT PRIME FARMLAND ISSUES UNDER THE ACT

A. New Permits

Illinois has implemented Section 510(d) of the Act ever since the Act was passed. Several new mines have come under Section 510(d)(1) of the Act, which requires the Department of Mines and Minerals to make a finding as to whether:

> The operator has the technological capability to restore such mined area, within a reasonable time, to equivalent or higher levels of yield as non-mined prime farmland in the surrounding area under equivalent levels of management and can meet the soil reconstruction standards in Section 515(b)(7).

Illinois has approached each permit application under this provision with care. In addition to review by the Department, Illinois procedures go beyond federal requirements and include an "interagency review" by the Illinois Departments of Agriculture, Conservation and Transportation, its Environmental Protection Agency, and the Institute of Natural Resources. Additionally, under Illinois law, which originated prior to the Act's passage, there is local review in the County where the mine is located, during which a hearing is held that becomes part of the record. Every comment is reviewed.

Because of some of the uncertainties surrounding the Act's implementation, and the fears of some people, the Department directly discussed the requirements for its decisions on prime farmland permits with OSM. As Acting

Director of OSM, Mr. Paul Reeves responded to Illinois' inquiries with a clarification and elucidation of OSM's expectations about how the judgmental process of determining permit issuance should be handled. Appendix D is a copy of a letter from Paul Reeves expressing the policy of OSM under the Carter Administration. Illinois' Department of Mines and Minerals has followed the procedures outlined by the prior Administration.

We can thus assure this Subcommittee that the Act is being fully implemented by Illinois. We look to OSM for national assurance that it is being enforced as vigorously in other states.

B. Grandfathered Prime Farmland Operations

The Conference Committee on the Act worked out a "grandfather clause" which allowed for continued operation of existing mines, without being subject to the immediate imposition of Section 510(d)(1). This was important to assure that committed investments, contracts and jobs were not jeopardized by the lack of data in 1977 with which to make the Section 510(d)(1) showing.

Illinois demonstrated to the Conference staff that a time period of at least five (5) years would be required to assemble good data from which to judge proposed prime farmland restoration plans on Corn Belt state soils. Illinois has been monitoring the research projects then and since underway on the special aspects of Illinois soil restoration.

The Department of Mines and Minerals consistently has had to fight for its idea that grandfathering was intended as a transitional device, and not an endless avoidance of Section 510(d)(1). Illinois carefully established a grandfather review policy based on OSM's interim program rules, including a determination that all grandfathering rights should terminate on August 3, 1982, the fifth anniversary of the Act. The Department's rationale is contained in large part in its opinion on the Captain Mine, which is Appendix E, hereto.

Unfortunately, Illinois' views on grandfathering as a process to be applied with national uniformity and according to rules has not been adopted by either the former or present OSM. Thus, while the prior OSM irrationally refused for what we believe were political reasons, to regard physically connected property as "contiguous" under its own rules, the present OSM has refused to adopt Illinois' idea of a uniform cut-off date.

Thus, Illinois will seek judicial review of the grandfather clause rule made final by OSM on September 29, 1981, that leaves to happenstance and state law whether a mine may go on for its lifetime or but a single year. Illinois should not be handicapped in its program of prime farmland protection by the competitive advantage given other states by OSM's refusal to adopt a reasonable end date for grandfathering.

C. Restorability of Prime Farmland After Mining

This Subcommittee may well receive different viewpoints on whether prime farmland can be restored to equivalent yield. We are pleased to say that there is more and more tangible evidence that supports expert opinion that this restoration can and will occur. Appendix F is a copy of a recent newspaper report of a five year research study undertaken by top soil scientists at the University of Illinois, showing that good corn and soybean crops can be grown on reclaimed strip mine areas. We are especially heartened because these results support use of the techniques of soil horizon mixing formulated in Illinois' Rule 1104. These techniques are cheaper to use than separate horizon handling and replacement, yet can be applied under the federal Act, which clearly allows alternatives to separate horizon replacement under Section 515(b)(7), upon proper showing of equivalency.

D. Regulatory Reform

Much alarm has been registered over OSM announcements of regulatory reform efforts involving surface mining. In the experience of the Department of Mines and Minerals, the prior OSM Administration seriously erred in implementing Congress' programs under the Act. Overregulation in the form of page after page of detailed rules was not accepted by the States, for the simple reason that, in addition to causing unnecessary administrative red tape and headaches, the Permanent Program regulations failed to accommodate the geographical and engineering differences in mines across the country.

Recently, a committee of the National Academy of Sciences issued its long awaited report on surface mining. This expert group corroborates the position Illinois and many other states maintained these past several years in the face of the overbearing OSM regulations. Some excerpts follow from that report:_/

> The appropriate approach to reclamation is, then, in the committee's view, primarily concerned with the functional aspects of the soil and water resources disturbed by mining. Reclamation should aim at establishment of desirable physical, chemical, and biological processes rather than simple replacement of the soil horizons in the order in which they were found. Moreover, the goal of returning to original contours is not valid if grading to different contours will achieve useful objectives. Finally, a change in use, including a change from native vegetation, may result in a new regime that is either a more stable and productive resource or is a more efficient means of developing an equally desirable resource. Thus, changes in the nature of the soil - its contours, vegetation, and use - from the original or pre-mined conditions may be appropriate.
>
> The goal of reconstructing soils after mining so as to equal or exceed the productivity of pre-mine soils, then, can probably best be accomplished by reorienting the reclamation laws away from selective handling and replacement of individual soil horizons and toward creating

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_/Surface Mining: Soil, Coal and Society, a Report prepared by the Committee on Soil as a Resource in Relation to Surface Mining for Coal, National Research Council of the National Academy of Sciences, National Academy Press, 1981. (all emphasis supplied) physical and chemical properties of mine soils that optimize the functions important for productivity (such as water-holding capacity, rooting depth, and fertility). Often, of course, the benefits of the surface horizon in terms of fertility, aggregation, and superior infiltration characteristics will justify selectively removing and replacing the surface soil. The soil horizons that develop through soil-forming processes are indicative of the soil's productivity but they are not necessary for a productive soil. In some cases, alteration of the pre-mine soil profile may be beneficial.

Clearly, reclamation plans must be tailored to the individual sites. Plans must recognize the physical, chemical, and biological character of the soil, the highly diverse impact of the weather, the use alternatives available, and the socioeconomic structure of the area. The major differences among the coal-producing regions-and the unique character of individual mine sites-make it imperative that laws be flexible enough to permit the most appropriate reclamation practices to be used at each site. This situation presents extraordinary challenges.

Differences in conditions also mean that reclamation costs will vary among regions. There is no reason, however, to attempt to make reclamation equally difficult and expensive in all areas in order to achieve national equity. Standards set to solve problems such as protecting uniquely valuable and fragile lands in one region should not be required in all regions simple for the purpose of maintaining equity. In the East, reclamation costs may well be high enough to influence whether an area is mined, although the cost data available do not suggest this will occur. In the West, where the coal seams are quite thick, the high per-acre costs of reclamation will translate into low costs per ton. These differences in cost of reclamation per unit of energy should quite properly be reflected in the price of coal.

ALTERNATIVE APPROACHES TO RECLAMATION

Surface mining and reclamation present massive challenges to the regulatory environment because each region and locality is different, as is extensively documented here. The complexity of the interactions among the geological, hydrological, ecological, and social systems in the context of surface mining and reclamation guarantees that the best practical set of design standards nationally imposed will occasionally have unreasonable and even absurd results in particular localities. A number of alternative approaches to regulation may increase flexibility and responsiveness to local circumstances. These alternatives range from rather minor changes in the traditional practices to some rather radical departures from the status quo.

The basic design-standards approach currently used could be applied with increased latitude in recognition of varying conditions. It would also be possible to establish design standards at the local level, subject to federal approval. A committee of experts could be appointed to review local standards, or control could actually be transferred to local areas.

Performance standards could replace design standards. These performance standards could be controlled at the federal, state, or local level as could design standards. Enforcement of performance standards is more difficult, but if workable measures could be developed, performance standards would provide considerably more flexibility and efficiency in meeting the intent of the law.

A system of economic incentives might be used to encourage the desired results. While it is not likely that a satisfactory effluent-charge type of system could be devised, it may be possible to develop a flexible bonding system under which the individual mine operator is returned bond funds as predetermined reclamation goals are achieved.

New forms of property and institutions could be developed. For example, individual communities could be given the power to veto the development of new mining activities in their areas. Communities would then prevent the development of mining activities unless the plans for control of off-site damages and for reclamation were acceptable. Such plans might include compensation to the community for those adverse impacts that are not controllable.

RESEARCH NEEDS

The development of appropriate reclamation policies and practices in the diverse environments of the several coal regions in the United States depends upon adequate technical information and an efficient and effective institutional setting in which to make choices. Research is needed in both areas. Long-term studies should be made of the full impacts of alternative reclamation approaches. Research is needed to characterize mine sites; on the weathering of mine spoils; on the movement of soluble nutrients, particularly in the high-rainfall areas of the South and East; on the hydrologic properties of the mined areas; on the appropriateness of grading to original or other contours; on means of avoiding or dealing with compaction of the root zone; on methods of controlling soil erosion; on appropriate vegetation regimes in the reclamation process; on the reintroduction of biological populations, nutrients cycles, and organic matter formation in new soil; on the appropraite level of productivity to which land should be returned and the time required to do so; and on the appropriate procedures for dealing with special problem areas.

Mining is related to a number of major policy issues in this nation. Energy, environment, economic, and social policies are all related, and their relationships need to be better understood.

CONCLUSIONS

Surface mining and reclamation clearly present a major challenge to the existing regulatory environment.

The compexity of the interactions among geological, hydrological, ecological, and social systems seem to guarantee that even the best practicable set of design standards, nationally imposed, will occasionally have unreasonable or even absurd results in particular localities. Important situations calling for variations include the following, some of which are allowed under current law.

The original A and B horizons are not invariably the most desirable topsoil material. They may have been naturally or articially degraded, in the sense that important or natural qualities necessary for good production are no longer present. For example, plant nutrients may have leached out, salts may have accumulated, or claypan may have formed. In the West, the surface soil horizons are often quite thin and lack the characteristics of a mature soil. In these situations replacing or mixing the A and B horizons with components of the overburden other than topsoil can lead to an improvement in the chemical, physical or biologicl characteristics of the root zone and thus a more productive resource.

Alternatives to the present sediment-and water-control methods that would accomplish the intent of the law more cheaply and that would be more consistent with overall water-use policy are being investigated. Also, in some western areas, the present regulations result in the use of scarce water resources for initial irregation on reclamation projects.

Reintroduction of climax native species may not always be the best means of initially achieving stable conditions, and considerable latitude should be present in the selection of species to be used in the reclamation process. After stability has been achieved, the site can be converted, by natural succession or replanting, to species consistent with long-term conditions.

In the West, where multiple use of rangelands for grazing, watershed, wildlife habitat, recreation, and other purposes is the accepted policy, stability and diversity are just as important criteria for determining the adequacy of reclamation as productivity. These are situations where these goals may be best achieved by allowing grading to contours other than originally present, allowing water bodies created in the mining process to remain, and even occasionally retaining a highwall to enhance habitat diversity.

Where noncropland environments or habits are in short supply and declining significantly, it may be appropriate to consider a more diverse use pattern. While the primary land use in the Midwest will be cropland, allotting some portion of the land to wildlife habitats may be desirable from ecological, aesthetic, and recreational perspectives.

The time allowed for the completion of the reclamation project might be considered one of the variable inputs to the reclamation process. Increasing the time allocated for reclamation may reduce the cost of reclamation and improve the eventual outcome, however, in some cases a return to original productivity in a short period of time may be the most desirable.

ALTERNATIVE APPROACHES TO RECLAMATION

It is widely argued that federal regulations in general, and in the particular case of surface mining and reclamation, tend to be insufficiently responsive to the often substantial variations among the different regions and localities affected. There are several reasons for this tendency. (1) For reasons embedded in the constitution and the political history of the United States, "police power" regulation seems to be the preferred method by which government directs the allocation of natural and economic resources. While economists generally prefer that governments direct the allocation of resources through the modifications of prices (i.e., through the power to tax), this route is seldom taken. (2) It is sometimes easier to use overbroad rules, which are not responsible to contingencies. Often it is simpler to determine whether required practices have been followed than whether required performance has been achieved, especially in areas such as surface-mine reclamation. These considerations lead to a political preference for regulation by design standards rather than performance standards. (3) Since the federal government does not directly possess the police power, it must achieve its regulatory goals by bringing pressure to bear on state or local governments. Administratively, it is convenient to treat all the states alive, even if this occasionally results in the inequity of treating unlike cases alike.

III.

THE ILLINOIS PROGRAM

Illinois expects to resubmit a permanent program proposal to OSM in November. The Illinois regulations are awaiting review by a joint committee of its General Assembly. The history of Illinois' efforts to adopt a program is a long one. It was Illinois' experience that the prior OSM administration did little to assist Illinois' preparation of a program. The atmosphere of distrust has now changed to a cooperative relationship, as intended by Congress.

In the course of the last three years, Illinois twice had to urge the U.S. District Court in Illinois to grant relief of unlawful or improper OSM decisions, first with respect to its grant funds, and second with respect to the former Secretary's partial approval and disapproval of Illinois' program.

It would do little to illuminate the path ahead to reiterate the multiple reasons Illinois was improperly treated by the prior OSM. We attach as Appendix G, a letter from Director Brad Evilsizer, to Secretary Cecil Andrus, summarizing Illinois' improper treatment at the hands of the prior OSM Administration. Lest any member of this Subcommittee have doubts as to their validity, we will be happy to have our counsel discuss or provide details to you on request.

Illinois expects to successfully complete its program development process soon. It has received a great many comments from members of the public and the coal industry on its program, and the program will be subject to further public review when sent to the Secretary.

Illinois expects to have its program approved and underway upon the Secretary's approval, which it projects for January, 1982.

APPENDIX A

Illinois Law Requiring Restoration of Productive Capacity, Effective July 1, 1975

Ill. Rev. Stat., 1979, Ch. 96½, par. 4507. Duties of Operator

§ 6. Duties of Operator. Every operator to whom a permit is issued pursuant to the provisions of this Act may engage in surface mining upon the lands described in the permit upon the performance of and subject to the following requirements with respect to such lands:

* * *

(j) When the Director determines that the land to be affected is (1) capable of being reclaimed for row-crop agricultural purposes and suitable for row-crop agricultural purposes based on United States Soil Conservation Service soil survey classifications of the affected land prior to mining, and (2) when the Director determines that the optimum future use of the land affected is for row-crop agricultural purposes, the affected land shall be graded to the approximate original grade of the land provided that the final cut and submerged roadways may remain if the Department determines that such final cut or roadways could form a water impoundment capable of supporting desirable uses such as water for livestock or wildlife; and if to be used for fish life, shall have minimum depths in accordance with standards for fish stocking as recommended by the Department, and provided further that the box cut spoil shall be graded in accordance with subparagraph (a) of Section 6:

The reclamation requirements in this Section do not apply to affected land used for a sanitary land fill if such sanitary landfill is approved by the Environmental Protection Agency. The Environmental Protection Agency may regulate the amount of land to be used for the purpose and may establish a time schedule for the orderly and timely completion of such sanitary landfill. Any affected land designated for sanitary landfill and not used for such purpose within 5 years is subject to the reclamation provisions of this Section;

On all affected lands to be graded to the approximate original grade under this subsection (j) all or part of the darkened surface soil, as defined in this Act, shall be segregated during the stripping process and replaced as a final cover as a last step in the required grading. When available in such depth, at least 18 inches of the darkened surface soil shall be segregated and replaced. When less than 18 inches of darkened surface soil exists all such lesser amounts shall be segregated and replaced. In no case under this subsection (j) shall less than the top 8 inches of surface soil, darkened or not, be segregated and replaced. This segregation and replacement requirement may be altered by the Department only if it is determined upon the advice of competent soil scientists that other material available in the cast overburden would be suitable in meeting the reclamation requirements. Below the darkened surface soil the replaced material shall be suitable as an agricultural root medium. The Department shall determine by rules and regulations what constitutes a suitable agricultural root medium of composition and depth. On all lands to be reclaimed under this subsection (j), the operator shall not be required to create a soil condition better than that which existed prior to surface mining;

APPENDIX B

STATE OF ILLINOIS

EXECUTIVE ORDER Number 4 (1980)

PRESERVATION OF ILLINOIS FARMLAND

The natural resources of Illinois—land, minerals, water, and air—are both finite and fragile. In the absence of wise use and consistent management practices, these resources are threatened by irreversible damage or loss. Protection of the State's natural resources is essential to guard the public health, safety, and welfare, and to assure an adequate natural resource supply and quality for use and enjoyment by future generations.

Since World War II, the amount of Illinois land dedicated to agriculture has steadily declined at an average rate of approximately 100,000 acres per year. This substantial loss of farmlands is the equivalent of eight average-sized Illinois counties. If this trend continues, the State will lose the equivalent of another five or six counties by the end of the century.

The conversion and loss of agricultural land has diminished Illinois' cropland base and affects environmental quality. The supply of land most suitable for farming is finite. Conversion of this land to urban development and other non-farm uses reduces future food production capability and may ultimately undermine agriculture as a major economic activity in Illinois. With less prime farmland available, there will tend to be greater reliance on marginally productive land, resulting in greater soil erosion, increased fertilizer requirements and increased environmental damage. Loss of agricultural land can also reduce the beneficial role which the land itself can play. Agricultural land reduces runoff by absorbing precipitation, aids in replenishing groundwater supplies and can buffer environmentally sensitive areas from encroaching development.

The importance of preserving our agricultural land base has been recognized by the Illinois Rural Planning Council, the Task Force on the Future of Illinois, and in the State's "Comprehensive Growth and Resource Conservation Policies". Each of these efforts recommends that the State minimize the conversion of prime farmland that results from the direct or indirect effects of State programs and also encourages the achievement of related goals, such as reducing the loss of soil through erosion.

Agencies of the Executive Branch perform numerous functions which affect the management of Illinois' natural resources, including the conversion of prime agricultural land. Decisions on State grants and capital improvements may have significant impact on the conversion process, yet often they may not adequately recognize that agricultural land is a finite resource that can be irretrievably diminished as a result of State actions.

Currently there is no single policy or coordinating mechanism to ensure that State actions do not unnecessarily encourage the conversion of prime farmland to non-farm uses, particularly when there may be alternatives available that are less destructive to our best agricultural lands.

Accordingly, I order the following:

I. It shall be the policy of the State of Illinois to protect, through the administration of its current programs and regulations, the State's prime agricultural land from irreversible conversion to uses which result in its loss as an environmental or essential food production resource.

II. The Department of Agriculture shall be the lead agency for implementing this policy in the State of Illinois.

A. The agencies named below shall each prepare and submit to the Governor, with a copy to the Illinois Department of Agriculture, an Agricultural Land Preservation Policy no later than one year from the effective date of this Executive Order. This policy shall include an analysis of the impact on agricultural land conversions caused by their programs, regulations, procedures and operations. The policy shall also detail measures that can be implemented by the agency which will mitigate conversions to the maximum extent practicable. Each policy shall provide for a greater degree of protection for Classes I, II, and III lands than for Classes IV through VIII (as defined by the U.S. Department of Agriculture). The agencies are: Capital Development Board, Department of Conservation, Department of Commerce and Community Affairs, Environmental Protection Agency, Institute of Natural Resources, Department of Mines and Minerals, the Department of Transportation, Bureau of the Budget, and the Illinois Commerce Commission.

B. Those named State agencies shall participate in an inter-agency committee chaired by the Illinois Department of Agriculture to solve mutual problems in meeting the objectives of agricultural land preservation.

C. The Department of Agriculture will analyze State funded capital projects that impact farmland conversion and advise the Governor's Office as to the consistency of agency actions with the policy established by this Executive Order.

D. After the second anniversary of this Executive Order, all conversions of agricultural lands by any State agency shall meet the criteria specified in that agency's Agricultural Lands Preservation Policy.

III. EFFECTIVE DATE

This Executive Order shall become effective on July 22, 1980.

James R. Thompson
Governor

APPENDIX C

* * *

SENATOR PERCY:

I would like to submit for the RECORD a copy of a letter I received this morning from Mr. Douglas Downing, supervisor of the land reclamation division of Illinois' Bureau of Mines and Minerals, in which he affirms Illinois' total commitment to prime farmland reclamation and a 1982 grandfathering sunset.

* * *

STATEMENT TO SENATOR CHARLES PERCY FROM THE ILLINOIS DEPARTMENT OF MINES AND MINERALS ON PRIME FARMLAND AND CROPLAND RECLAMATION

The State of Illinois has consistently and historically advocated quality reclamation. We have every intention of promulgating and enforcing a law and regulations which carry out the requirements of P.L. 95-87. Two specific examples will prove that Illinois had the goal of good reclamation before the federal law was passed, and that we continue to impose requirements in excess of the federal law to insure retention of agricultural capability on the maximum number of acres.

First, in 1976, Illinois enacted Rule 1104, developed by soils scientists of international reputation from the University of Illinois and other Illinois schools. Rule 1104 has been adopted by the Illinois legislature for the permanent program, even though the federal law doesn't require it. During the permanent program, under Rule 1104 standards, operators will be required to return to rowcrop capability, land which does not meet the definition of prime farmland, but which is nevertheless capable of producing rowcrops. By contrast, the federal regulations merely require that such land be revegetated. Since there are approximately 1,023,181 acres of land in Illinois mining counties which would be subject to Rule 1104 standards but not to prime farmland requirements, this means that Illinois would require a return to rowcrop capability for over one million acres more than would federal law alone.

Second, the State of Illinois was the originator of the idea to limit prime farmland grandfathering to 1982. Such a limitation has been placed on every single exemption granted by Illinois despite the fact that no time limitation is contained in the Federal Act or has ever been contained in adopted federal regulations. However, OSM has adopted this idea and is now proposing it as part of its proposed exemption regulations.

To date, Illinois has issued permits for approximately 2,700 acres upon which a prime farmland restoration plan has been submitted and approved. The federal prime farmland standards will apply. More acreage will be subject to these standards as time goes on, since Illinois has always interpreted the grandfather clause as a transition exemption only, as is obvious from the 1982 limitation. Of the acreage grandfathered by Illinois under the federal Act and regulations, only about 12,000 acres of it will actually be mined. Rule 1104 standards apply to grandfathered land. It's time that the facts be made known concerning the reclamation which will be required of grandfathered land in Illinois. The exempted land will have a minimum of eight inches of topsoil saved and replaced. Under the federal prime farmland rules, only a minimum of six inches would have to be saved and replaced. The entire rooting media of exempted land will be 4' deep. Under the federal prime farmland rules, the rooting media would be 4' also, unless there was a root inhibiting zone, or fragipan, within the premining surface 4', in which case the prime farmland rules only require rooting media to the depth of the premining fragipan. Finally, the exempted land will have a rooting media of a mixture of the B-C horizon. Under the prime farmland rules, a mixture of the B-C horizon is specifically allowed. The exempted land will be released from bond only when capability to achieve 90 percent of premining yield is shown.

Illinois is adopting the prime farmland standards and will enforce them, because there is a negligible difference between those standards and Rule 1104 standards, except for the many acres of fragipan soils in Southern Illinois. However, we will continue to apply Rule 1104 standards to restore the rowcrop capable land that is left out of the federal prime farmland requirements.

DOUGLAS DOWNING
Supervisor, Illinois Department
of Mines and Minerals

* * *

FACT SHEET: GRANDFATHERING IN ILLINOIS

(Approximate acreage)

Total Acres Grandfathered[1] To Date (8/80) 29,903.
Prime Farmland Grandfathered, 16,059.
Prime Farmland Grandfathered which is planned to be mined, 12,143.
Federal Prime Farmland Restoration Plan—Approvals to Date (approximate acreage), 2,700.
Grandfathered land—1104 Reclamation Standards, Minimum of 8" topsoil salvaged Root Zone 4' deep.

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[1] For convenience, exemptions are requested and granted or denied for entire permit areas, without specifically delineating prime farmland soils within the permit areas. In other words, this figure represents both prime farmland and non-prime farmland.

9a

Federal Prime Farmland Reclamation Standards, Minimum of 6" topsoil salvaged. Root zone 4' deep, or less if root inhibiting zone, in which case root zone restored only to depth where premining root inhibiting zone existed.

Root zone of B/C mixture. Texture requirements for root zone: Maximum of 40% clay content.

Root zone B over C or B/C mixture. None.

Prime Farmland and Rule 1104 Land, Illinois Mining Counties (Approximate Acreage):

Prime Farmland, 2,049,800.
Row Crop in Excess of Prime Farmland, 1,025,181.
Prime Farmland Plus Row Crop, 3,074,981.

* * *

United States Department of the Interior
OFFICE OF SURFACE MINING
Reclamation and Enforcement
WASHINGTON, D.C. 20240

[illegible]
APR 14 1980
DEPT. OF MINES AND MINERALS
LAND RECLAMATION DIV.

APR 7 1980

Mr. Brad Evilsizer
Director
State of Illinois
Department of Mines and Minerals
Springfield, Illinois 62706

Dear Mr. Evilsizer:

Re: Prime Farmland Findings Under
§ 510(d)(1) of the Surface Mining
Control and Reclamation Act

This will confirm receipt of your letter of March 31, 1980. In response to your letter, please be advised that, based upon a review of the statute and regulations, together with relevant policy discussions within the Office of Surface Mining, that it is my opinion and the policy of the Office of Surface Mining that the written finding of a regulatory authority under Section 510(d)(1) of the Act, 30 U.S.C. § 1260(d)(1), with respect to an applicant's ability to restore prime farmland, within reasonable time to equivalent or higher levels of yeild as non-mined prime farmland in the surrounding area under equivalent management is a matter to be decided by the regulatory authority, based on substantial evidence in the record. The permit applicant has the burden of making the showing whether he has this technological capability. Such evidence of technological capability to achieve the desired soil productivity may consist of expert opinion that it is technologically possible to return the prime farmland in question to its prior productive capacity if a well-planned soil restoration plan, consistent with the Secretary's regulations, is carefully followed. The Office of Surface Mining does expect and require a regulatory authority to consult with the Secretary of Agriculture, or his duly designated representative, prior to making a finding, and the Secretary's regulations require that available agricultural school studies or other scientific data for areas with comparable soils, climate, and management, showing the capability of an operator to achieve the desired reclamation, be submitted to and reviewed by the regulatory authority as part of the permit application review process. The State regulatory authority must, of course, also consider other evidence properly of record before it.

APPENDIX D

Page Two.

I trust the above statement sufficiently describes the finding required by the Act and the Department's regulations, so as to enable the Illinois Department of Mines and Minerals to proceed in the future to review prime farmland mining and restoration plans submitted under § 510(d)(1) of the Act.

Sincerely yours,

Paul L Reeves

Acting Director, Office of Surface
Mining Reclamation &
Enforcement

APPENDIX E

Before The
STATE OF ILLINOIS
DEPARTMENT OF MINES AND MINERALS
SPRINGFIELD 62706

BRAD EVILSIZER
Director

LAND RECLAMATION DIVISION

* * * * * * * * * * * * *

IN RE:	SOUTHWESTERN ILLINOIS COAL CORPORATION) (THE CAPTAIN MINE))	DOCKET NO.
	)	
	)	RA 78-1

OPINION AND ORDER

I. Background

This matter involves a request by Southwestern Illinois Coal Corporation ("Southwestern" or "the Company") for approval of an exemption from the prime farmland requirements for permits issued by the Director and Land Reclamation Division in the Illinois Department of Mines and Minerals (the "Regulatory Authority") in compliance with the Federal Surface Mining Control and Reclamation Act of 1977 (30 U.S.C.1201 et.seq.), and the regulations issued thereunder (30 CFR Part 700 et.seq.). Southwestern submitted its request for a determination that the surface mining operations conducted under Illinois Permit No. 704-81 issued on July 1, 1978, were in compliance with 30 CFR Part 716.7(a) (2) (iii) and, thereby, exempt from certain prime farmland requirements found in 30 CFR Part 716.7.

Southwestern submitted its request at a meeting with the Authority on August 17, 1978, and delivered certain documentary support thereof at that time. On August 28, 1978, the Regulatory Authority issued its Emergency Regulations for

Illinois Coal Mining Operations under P.A. 80-1342. Part 7.2 of the Emergency Regulations provides for an exemption from the prime farmland requirements based upon a written request for a determination made within 45 days of the effective date of the emergency regulations. The Authority will treat the request submitted by Southwestern as a request for exemption under Part 7.2 of the Emergency Rules, and Section 510(d)(2).

II. Authority

On August 3, 1977, Congress passed the Federal Surface Mining Control and Reclamation Act of 1977. The Federal Act required the Office of Surface Mining in the U.S. Department of the Interior to promulgate rules for an interim regulatory process within 90 days of the enactment of the Federal Act, 30 U.S.C. 1251. These rules were promulgated on December 13, 1977. (30 C.F.R. Parts 700 et.seq.)

Sec. 502 of the Federal Act provides that a State's regulatory authority may issue permits under the Federal initial regulatory program. However, all permits issued by a State under the initial regulatory program must incorporate the minimum standards of the Federal Act and the initial regulatory program. One of the requirements calls for certain findings to be made by the regulatory authority prior to the issuance of a permit where the affected area includes prime farmland. Section 510(d), P.L. 95-87, 30 U.S.C. 1260(d).

Finally, Illinois Public Act 80-1342 expressly designates the Director and the Land Reclamation Division within the Department of Mines and Minerals as the "Regulatory Authority" for purposes of the Federal Act.

III. The Prime Farmland Exemption

The Federal Act contains a "grandfather clause" in Sec. 510(d)(2), intended to relieve existing operations of the prime farmland requirements (30 U.S.C. 1260(d)(2)). The grandfather clause was applied to the initial Federal regulatory program by the language of 30 CFR Part 716.7(a)(2).

Section 17(d) of the Public Act 80-1342 includes the grandfather clause of Section 510(d)(2) in the Illinois statute. Sec. 17(d), P.A. 80-1342. The clause is further implemented by the Part 7.2 of the Authority's Emergency Regulations.

The language of the Federal Act and the State Statute, and the implementational language for the two statutes in the Federal and State regulations, indicates that the granting of a prime farmland exemption by the Authority will necessarily result in an exemption under the Federal regulaiory scheme.

IV. Facts.

Part 7.2 of the Emergency Regulations expressly places the burden of establishing an exemption upon the applicant. In order to meet its burden, Southwestern has submitted extensive materials, which include documentation of the history of the mine, its topography and geology, permit history, coal contracts and several maps and diagrams. It futher submitted a memorandum in support of its position on August 31, 1978. Examination of the materials submitted demonstrates, and the Authority finds, the following facts, in addition to those contained elsewhere in or directly or necessarily to be implied from this Opinion:

a.) Southwestern was issued Permit No. 582-79 on July 1, 1976.

b.) The affected area in Permit No. 582-79 is located in Township 65, Range 3W, Sections 6, 7 and 18 in Perry County, Illinois.

c.) The area affected in Permit No. 582-79 was developed and partially mined prior to August 3, 1977, and designated Pit 2570.

d.) The application for Permit 704-81 was filed after August 3, 1977.

e.) Permit No. 704-81 was issued on July 1, 1978.

f.) Permit No. 704-81 affects areas in Township 65, Range 3W, Sections 6, 7, 18 and Township 65, Range 4W, Sections 12 and 13 in Perry County, Illinois.

g.) The areas affected in Permit No. 704-81 touch and border on the areas affected in Permit 582-79.

h.) The areas affected in Permit 704-81 will be developed as part of the same pit as the affected areas of Permit No. 582-79.

i.) The coal mined from the affected areas of Permits No. 582-79 and 704-81 will utilize the same tipple, or processing plant, and is drawn from a geographically distinct mine site.

j.) The Illinois Environmental Protection Agency on May 21, 1976, issued a permit which covers all of the areas affected in Permit Nos. 582-79 and 704-81.

k.) Areas affected by the permits have similar soil types, vegetation, topography and prior land uses.

l.) The coal mined in the areas affected under Permits 582-74 and 704-81 is contained in the Harrisburg No. 5 and Herrin No. 6 coal seams, which are continuous seams in the area in question.

m.) The mining operation designated by Southwestern as Captain Mine came into existence on or about October, 1964, and has continued from that time to the present.

n.) The Company declared to the Illinois Department of Mines and Minerals in 1964 that the estimated life of the mine was 50 years, per a signed Inspection Report.

o.) A long-term contract with a utility customer for delivery of coal from this mine until 1994 was in existence prior to August 3, 1977, and remains in effect.

p.) The Company documents independent consultant reports and Company decisions to invest in a new dragline and otherwise to plan for mining of the subject area several years prior to August 3, 1977.

V. Discussion

Southwestern bases its request for an exemption upon Section 7.2 of the Emergency Regulation:

> Revisions or renewals of such permits (permits issued prior to August 3, 1977) under the 7.2 shall extent to and include only those areas that:
>
> . . . .
>
> b.) are contiguous to areas for which a permit was issued or a mining plan approved before August 3, 1977, and which under state law or regulation, or practice, normally would have been considered a renewal or revision of a previously approved mining plan.

In order to carry its burden Southwestern must show:

1.) That the affected areas in Permit 704-81 are "contiguous" to the affected areas in Permit 584-79, and

2.) There exists a state law, regulation or practice which would consider the affected areas in Permit 704-81 a renewal or revision of the previously approved mining plan in Permit 582-79.

The word "contiguous" has been defined as "touching along boundaries often for considerable distances" and as "next or adjoining with nothing similar intervening". (Webster's Third New International Dictionary, 1966). Further the Illinois Supreme Court construed the word contiguous as used in the Revised Cities and Villages Act as follows:

> "In giving effect to the word 'contiguous' no strained, strict or unusual definition should be applied, but practical and common sense should prevail by adopting the sense best harmonizing with the context and promoting the apparent policy and objects of the legislature in the light of the general purposes of the act." (Citation omitted). People Ex.Rel. Montgomery v. Lierman, 415 Ill. 32, 37 (1953).

The Department of Mines and Minerals believes the purpose of the grandfather clause, and Congressional intent, is to assure continued operation of ongoing mines. See e.g. H.R. Rep. No. 493, 95th Cong., 1st Sen. 105 (1977).

Under any reasonable definition of contiguity, the area in question under the request for exemption must be considered to be "contiguous" and it is bordered with pre-August 3, 1977 permitted areas, in part by the area under permit in

1976. Based upon consideration of the materials submitted by Southwestern, the Department hereby determines and holds that the areas affected by Permit 704-81 are contiguous to the area affected in Permit 582-79.

In order to meet its burden of showing that a state law regulation, or practice existed which would treat Permit 704-81 as a renewal of previously approved plans, Southwestern submits the following;

a.) Rules 204(d) and 102(k) of the Mines and Minerals Rules promulgated March 18, 1976.

b.) Sec. 15 of the Illinois Surface-Mined Land Conservation and Reclamation Act.

c.) The issuance of a single Permit by the Illinois Environmental Protection Agency for all of the areas affected under Permits 582-79 and 704-81.

d.) Submittal of information to the Department of Mines at the time of mine development in 1964, that a 50 year life expectancy existed for the mine, and

e.) Investment of capital and property indicative of intent to engage in longterm development of the coal vein, including the subject area.

The Department believes that the above facts and arguments, as well as additional authority contained elsewhere in the Act and regulations, indicates that a state practice exists which would consider Permit 704-81 a renewal or revision of a previously approved mining plan contained in Permit 582-79. The area for which exemption is sought is practicably within a single mining site for which plans were made and approved.

It should be noted that the terms "renewal and revision" as employed in the Federal Act are alien to Illinois law as it existed before August 3, 1977, and did not appear until P.A. 80-1342 became law. Earlier Illinois law requires permits to be obtained, which are of three years duration. There is an "extension" of a year's duration available as to twenty-five per cent of earlier permitted acreage. A new permit is required for areas not eligible for extension or amendment. Ch. 96-1/2 Ill.Rev.Stat. Ch.96 1/2 Sec. 4506(b), (d).

The Authority must therefore give meaning to the terms "revision or renewal", as well as the term "practice", in ruling on exemption requests such as the present request.

The Authority has examined whether "revision or renewal" under federal law must and should have the same meaning as "amendment" and "extension" under Illinois law. The Authority believes such an interpretation would be inequitable and inappropriate, inasmuch as the federal law and regulations themselves contain differing definitions of these terms. Moreover, the Authority takes notice that laws of different states prescribed different meanings to the terms "permit", "renewal", and "revision". Thus, for example, in Wyoming, permits are issued for the life of the mine based upon a mining plan submitted with the application. Moreover, although it might be argued that the Congress was aware of the divergent practices among the states, and thus somehow intended diverse results and burdens to fall upon coal operators depending on the fortuity of where they had invested money to develop a mine, in fact the "grandfather clause" and the language making Section 510(d) immediately effective was a last minute compromise addition to the Federal Act, which originated in Conference Committee within but a day or two of concurrence by that Committee upon the final form of P.L. 95-87. Under such circumstances, an arbitrary and disharmonious result is not to be imputed to Congress.

The new federal law prescribes that under the permanent program, yet to be instituted, the duration of mining permits shall be not more than five years. Sec. 506(b). Moreover, "renewals" for additional time periods are expressly mentioned, and can occur automatically so long as they cover areas within the original permit. Sec. 506(d). "Revisions" are available under the federal law, to allow changes in mining and reclamation plans, and incidental permit area boundary revisions. Sec. 511(a). The Office of Surface Mining has further defined "Renewed Permit" in the context of small operator exemption, to mean:

> "and extension of the original area or duration of a permit." 30 CFR Sec. 710.12(a)(2).

(The small operator exemption is a limited delay in applicability of the law to coal mining of a prescribed small scope, originating in Section 502(c) of the Federal Act. Nothing in the Section 502(c) small operator language or in the regulation indicates that any special meaning of the term "renewal" is parochially assigned to small operators.)

Thus the federal law and regulations in existence indicate a very different meaning for the terms "renewal" and "revision" than that meant by "extension" or "amendment" in prior Illinois law, and the Authority therefore interprets Illinois law and the Federal Act with a view to national consistency, and with a meaning different from, although complimentary to, "amendment" and "extension" under prior Illinois law.

Further supporting the difference in terminology is the fact that 30CFR Sec. 716.7(a)(2) and Emergency Reg. Sec. 7.2 deal with revision and renewal of a previously approved "mining plan" and not renewal or revision of a permit. It is clear that the overall mining plan for the Captain Mine was known, and, under Illinois practice, was "approved" prior to August 3, 1977.

The Authority thus finds and determines that if the federal definitions had been in effect in Illinois prior to August 3, 1977, the area within the present request for exemption would likely have been included by Southwestern within the original permit area, by reason of its natural characteristics and logical extension of contemplated E-10 mining plans by Southwestern. This view is legally supported by the express language of Congress in adopting the grandfather clause, in stating that exemption applies to:

> "Any permit issued prior to August 3, 1977, or to any revisions or renewals thereof, or to any existing surface mining operations for which a permit was issued prior to August 3, 1977."

In other words, the land in question is clearly part of an existing surface mining operation subject to a mining plan for which a permit was issued prior to August 3, 1977, within the meaning of Section 510(d)(2) and Section 17(d) of P.A. 80-1342. In the context of Congressional intent, it is part of a mine "open for ongoing operation" prior to August 3, 1977. Thus, the land in question would have to be viewed as subject to renewal under the Federal and Illinois law, and, as being eligible for permit renewal under these statutes.

The Authority further holds that the "practice" in Illinois regarding issuance and renewal of permits is a blend of pre-existing written law and regulation and certain reasonable and practical expectations of mine owners and the Department of Mines and Minerals, all taken in context of the meaning and purpose of the revised Federal and State laws.

The Authority's consideration of the above issues is not without likely controversy, because it is a matter of first impression having important economic and legal ramifications. The Authority believes it is therefore appropriate to take note of the Opinion and Order of the District Court for the District of Columbia. In In Re Surface Mining Regulation Litigation, 452 F. Supp. 327, 11 ERC 1593 (May 3, 1978) the District Court for the District of Columbia noted that without the limitation on grandfathered extensions placed by OSM, namely, that they must have been "contiguous" and "under State regulation or practice would have normally been considered a renewal or revision of a previously approved mining plan", Congressional intent would be violated since mining might otherwise extend indefinitely.

In the context of the Court decision, the Authority notes and makes the finding that the mining plan of the Captain Mine was effectively approved prior to 1977, in the context of submittals by the Company of useful life projections and state permit authority, and for other reasons cited herein. It should be noted for example, that EPA could not have issued its permit in 1976 until after the Department acted. Ill.Rev.Stat. ch 96 1/2, Sec. 4518.

Thus, Illinois practice clearly contemplated the issuance of the permit subject to the present exemption request, and the request is granted as to Permit 704-81. The request is also granted as a renewal for an ongoing operation within the intent of Congress.

Because of the importance of this initial, decision on this subject of the Illinois Regulatory Authority, the

Authority believes it appropriate to delineate the extent to which Illinois practice will be found to allow for similar exemptions. Illinois practice, as a blend of regulation and expectation, does not extend to unlimited expansion of mining areas or for unlimited periods of time. It would have been an unreasonable expectation of an operator, and was not the expectation of the Authority before August 3, 1977, that unlimited extensions could be granted without changes in the law occurring from time to time. Also, "expectations" as used in this opinion must be real, and found by the Authority to exist based on documented evidence of the type cited herein. In the context of the federal act definitions of permit, renewal, and revisions, and the time frame reasonably necessary respecting Illinois soils, to assure continuance of ongoing operations for a reasonable time, the Authority declares its intent to limit exemptions to a period of 5 years from August 3, 1977, (which is the same period as a federal permit) and to areas contiguous, for mining purposes, with pre-August 3, 1977, mining operations. Furthermore, the above time frames may be shortened in a given case depending upon factors such as the physical characteristics of a mining site, the coal recovery equipment and investment of the Company on August 3, 1977, (including the useful life of such capital equipment), the documentation of pre-August 3, 1977 mining plans, the contractual commitments of the particular mine, and particular local factors involving land use and public concerns which would have been expected before August, 1977, to limit mine development when and if new Illinois permits were sought. The above declaration of intent will apply as Authority policy and practice unless otherwise determined as a matter of law to be improper.

WHEREFORE, as stated and found above, it is hereby Ordered that Southwestern Illinois Coal Corporation qualifies for an exemption from Part 7 of the Illinois Emergency Regulations, and from determination or findings under Section 510(d)(1) of the Federal Act, for an area and time allowed by Permit 704-81, with any further renewals or revisions, if allowed, to be limited as stated in the above opinion.

ENTER, on behalf of the Director and Land Reclamation Division, Illinois Department of Mines and Minerals, as Regulatory Authority.

Signed: Brad Evilsizer
Brad Evilsizer
Director, Illinois Department
of Mines and Minerals

DATE: October 19, 1978.

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APPENDIX F

Marion Daily Republican, Marion, Illinois—Wednesday, October 7, 1981—3

Turning strip-mined land into crop land

ASTORIA, Ill. (UPI) — Preliminary research shows old strip mines can be reclaimed for productive farm land, says a University of Illinois agronomist.

Agronomist Ivan Jansen, head of the research team, Tuesday reported findings from five mine reclamation projects at strip mines at Astoria, Eads, Marissa, Norris and Percy in Illinois. The project will continue for another five years, he said.

"We have learned we can grow good corn and soybeans on newly reclaimed land under favorable weather conditions," Jansen said at a news conference.

The research shows the use of a blended soil mixture allows corn and soybeans to grow while the soil structure rebuilds itself after strip-mining, Jansen said.

Ben Jones, associate director at the U of I Agricultural Experiment Station at Urbana, said the project addresses the "real world problems" of producing energy while maintaining food sources.

"Surface mining and reclamation are costly and consumers are paying most of those costs," Jones said. "It costs more to reclaim surface-mined land than even the best agricultural land is worth. Yet, we must protect our future capacity to produce foo ."

During the five-year study, Jansen said strip-mined areas were rebuilt using a mixture of subsoils and materials from deeper underground, then topped off with the original topsoil. He said this mixture provided a good plant root environment while the natural structure redevelops.

In fact, Jansen said the mixture may eventually become superior to some of the undisturbed soils around the strip-mined areas, particularly in southern Illinois.

He said soil in the southern part of the state — where more than 75 percent of the state's surfaced-mined coal is produced — are strongly acidic and have nutrient-deficient subsoils. These problems can be alleviated in some cases, he said, by adding carefully selected materials from beneath the natural soils.

One drawback, Jansen said, is newly reclaimed soil is more susceptible to weather conditions, especially drought.

Another problem is the lack of microorganisms in the materials from beneath the subsoils. In spots where the topsoil was not replaced, Jansen said, the plots showed "severe plant stunting."

"Natural soil is full of microorganisms, which play an important part in plant growth," he said. "So you get severe crop stunting the first year, but by the second year the microbial population is re-established."

Ideally, Jansen said, the reclaimed land should be used for forage crops for several years before corn and soybeans are planted. But, he said, it is possible to immediately begin row cropping.

Half of the 64 plots at the Astoria field were planted in corn and soybeans while the remainder produced hay.

"The best management, we feel, is to let it lay a few years and then go into row-crop production," Jansen said. "If I had a market for hay, I'd let it lay four or five years. If I didn't have a market for hay, I would go right into corn and soybeans."

Normal tillage methods were used on the experimental plots but an increased amount of fertilizer was used to to promote a rapid buildup.

With the help of a $1 million grant from five major coal companies — Amax Coal, Consolidation Coal, Freeman Coal, Peabody Coal and Southwestern Illinois Coal — the University of Illinois research project will continue another five years, Jansen said. It is the largest reclamation project for row crops in the country.

NEWS from the Department of MINES AND MINERALS

November 19, 1980

SPRINGFIELD

Director of the Illinois Department of Mines and Minerals Brad Evilsizer has requested the U.S. Department of the Interior to review its earlier decision to require Illinois to resubmit its plan for a state mining program.

Without an approved state program in place, the state faces federal disapproval of its mining program, which will cause the eventual loss of federal funds for its abandoned mined lands program.

In a letter to Interior Secretary Cecil D. Andrus, Evilsizer said: "Illinois' submittal of a permanent program was not given proper consideration by your Department."

Evilsizer described the Department of the Interior Office of Surface Mining review of the Illinois submission as "clearly incomplete," "capricious" and "plainly contrary" to the law.

As a result of the Interior Department's incomplete review, Illinois has been charged with deficiencies which have already been resolved, or which do not exist, Evilsizer said.

A copy of Evilsizer's letter to Andrus is attached.

APPENDIX G

STATE OF ILLINOIS
DEPARTMENT OF MINES AND MINERALS
SPRINGFIELD 62706

November 17, 1980

The Honorable Cecil D. Andrus
Secretary of the Interior
Department of the Interior
Washington, D.C.

Dear Secretary Andrus:

We have received the initial decision on the Illinois program submitted under Section 503 of the Surface Mining Control and Reclamation Act of 1977. As you probably know, Illinois must resubmit its program within 60 days of publication of the decision in the Federal Register on October 31.

Your letters of early October to Governor Thompson and me indicated appreciation for Illinois' efforts to obtain permanent program approval. My staff has now completed its initial review of the OSM documents which have become available to us as a result of your decision. I regret that we have concluded that the documentation of your decision leaves us in great doubt as to the attention and quality of OSM's analysis of our program, to the extent that our ability to prepare a resubmittal is critically impaired. We believe for the reasons highlighted below, that the best means of assuring Illinois proper program review is a stay and reevaluation of your initial decision.

After reviewing the initial decision, we have found OSM did not review all material submitted on the record by Illinois, nor did it evaluate the Illinois program as a whole. This letter is intended to highlight our chief concerns at this point in our review. It follows a meeting with your staff on October 31.

Perhaps the most important and unfounded decision you have reached is the determination that Illinois' special attention to lands capable of rowcrop production (other than prime farmlands) is less stringent than the federal law. The federal Act, and Illinois' law, both expressly require topsoil removal, segregation and replacement on these lands. Illinois' advisory committee of experts, and its General Assembly, went on to require a total of at least 48 inches of optimal root media, from the replaced darkened surface soil or other comparable soil. Thus some one million acres of rowcrop capable land would be restored to rowcrop capability not required by the Federal Act. Incredibly, contrary to your document's own acknowledgment that this procedure is "in addition to" federal requirements, and despite the advice of your Bureau of Mines that it is more stringent than federal law, you disapproved this provision of Illinois law as less stringent than the Federal Act. Thus, with a stroke of a pen, techniques developed with the advice of nationally known academic and other experts were stricken from the program of a sovereign state. We do not know of a single soils scientist of credible credentials who would support this outrageous conclusion; moreover, it is unsupported by basic textual analysis of the Illinois law. I might add that the relevant federal and state rule provisions are currently in effect and accepted as lawful "more stringent" practice in the interim program. Thus, your initial decision appears totally at odds with known practice in the field.

The incompleteness of OSM's review is apparent generally because no mention whatsoever is made of Volume 12 and 13, acknowledged as submitted by Illinois on July 30, 1980. These volumes contained detailed analysis and rebuttal by Illinois of public comments received, most of which were also submitted to OSM, many within two days of the close of the public record. The failure to analyze Volumes 12 and 13 of the July 30 submittal, which contained all comments on Illinois' proposed rules and Illinois' response to them, is particularly harmful to Illinois' efforts at obtaining jurisdiction over the program. Review of these responses would have aided OSM in evaluating the public comments it received during its public comment period, and could have led to different conclusions than those made adverse to Illinois.

Additionally, failure of analysis can be shown in several additional important instances of materials received. On May 22, 1980, OSM Region III submitted to Illinois a "preliminary adequacy review of the Illinois Program Submission". Illinois responded to those concerns in Vol. 10 of its submittal, which was delivered to Region III on July 30, 1980. Nevertheless, the initial decision cites several of the same concerns (some verbatim) as did the May 22 letter, referring to the March 3 submittal as the deficiency.[1] As a result, all of the work which was done in response to OSM's May 22 letter, by all appearances, was initially ignored, even though it was submitted while the administrative record for the Illinois program submittal was still open. The July 30, 1980 submittal was made in person in Indianapolis and Illinois emphasized the extensive work done to respond to the OSM concerns, requesting OSM's attention especially to its July 30, 1980 submittal.

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[1] Findings 14.5, 15.8, 15.9(A), 18.5, 19.4, 20.5, 20.6, 20.7, 20.9, 20.10, 20.11, 20.12, 22.5, 23.19, 23.20, are some examples.

When apprised of the apparent failure to review the July 30 response to the May 22 letter during a meeting in Chicago on October 31, your personnel asked us to prepare a list of problems set forth in the initial decision which were answered on July 30. This letter includes our initial effort at that analysis. Your personnel also acknowledged possible failure to look at Vol. 10 thoroughly. Before we completed our initial review, OSM telefaxed a letter on November 10 containing a re-evaluation of "findings" which were addressed in the July 30 submittal. Several problems were deemed resolved in this letter. However, this letter referred only to the narrative portion of the July 30, Volume 10 submittal. On July 30, Illinois also submitted responses to the May 22 letter concerning alleged problems with the Illinois statute, submitted (in Volume 11) a full set of regulations which had been revised after public hearings and two meetings with OSM Region III, and submitted state window requests for some of the problems in the regulations upon which OSM Region III and Illinois could not agree. These responses were not addressed in the November 10 letter, and it appears that OSM ignored them. Your Federal Register notice goes so far as to conclude that Illinois did not submit state window requests, despite the letter acknowledged as received from us on this subject, dated July 29, 1980.

A further manifestation of the incomplete review which was done by OSM is the apparent evaluation of the Illinois Act separately from the Illinois regulations. In several instances, OSM finds the Act inconsistent with the federal Act merely because the Illinois Act states that something will be provided for by rule, without further examining the submitted rules which frequently rectified the alleged inconsistency in the March 3 submittal, and in almost all cases did so in the July 30 submittal.[2] In some cases, OSM finds the Illinois Act inconsistent with the federal Act because OSM has misconstrued the Illinois Act or has not been sufficiently thorough in its review of all materials, submitted, including the regulations.[3] In other cases, there is no apparent logical explanation for OSM's findings, which seem absurd on their face.[4]

2/ e.g. Findings 23.1, 23.4.

3/ Findings, 23.2, 23.3, 23.4, 23.5, 13.8, 23.11, 23.12, 14.2, 14.4, 14.5, 14.6, 14.8, 28.2-28.4, 20.10, 21.3, 19.3, 22.2, 30.2, 30.3, 30.4, 30.5 are examples.

4/ e.g. Finding 14.13.

With respect to the July 30, 1980 regulations submitted, I believe it bears repeating that your personnel were apprised that they were developed as a result of extensive public and OSM comment. Moreover, they were presented, before the record closed, as in the form to be adopted. In fact, except for clerical corrections, they were adopted on September 3, 1980, as promised your staff, to enable you to conditionally approve Illinois' submittal. Instead of making your decision September 3, you delayed at least until October 3, when you signed a brief and uninformative decision document. Your Department did not complete "your decision" until approximately October 27, when it was forwarded to the Federal Register. Even then, on the face of Walter Heine's letter of October 30 and Edgar Imhoff's letter of November 10, the document published in the Federal Register did not include a full review of the revised Illinois regulations and other comments made by Illinois. Thus, the sovereign state of Illinois, the party most affected by your decision, got less attention than comments made by citizen's and other groups, and is unaware whether the ancillary letters, insufficient as they may be, even express your thoughts.

To the extent you made a decision on review of Illinois' Act, we find a number of issues were decided in a way which begs credibility. For example, although the federal Act indicates judicial review of state regulatory authority decisions is to be in accordance with State law, your decision demands it comply with federal review provisions. Also, although states are to develop a process to designate lands unsuitable for mining, including public hearings expressly designed to obtain competent, scientific evidence, you have somehow deemed it inconsistent for Illinois to allow persons affected by such hearings to adduce formal testimony, to have the aid of counsel, or to subpoena and to cross-examine witnesses.

The result of your initial decision is that in order to obtain authority for a state program, I must ask the Governor to commit to ask the General Assembly to forget about the work of experts in Illinois designed to obtain greater protection of vast acres of land, to sack Illinois' time tested procedures for judicial review, to deny to persons whose property rights and value may be wiped out by our rulings the right to cross-examine witnesses against them. You also ask us to make other changes in a law that is expressly written to be construed consistently with the Federal Act, which almost uniformly can be supplemented by regulations to do whatever is required. It is my conclusion at this time that the requests you are effectively making exceed the intent of Congress, common sense, and the demands of the Federal Act.

The next regular session of the Illinois General Assembly is not until January. Thus, the requirement of state laws consistent with your demands, even if your demands were deemed sensible, is a practical impossibility, since such a result is not likely, even if desired until at least the Spring of 1981.

Numerous other problems can be documented. For example, after the two meetings with OSM Region III on June 6 and 9 concerning the May 22 comments on the regulations, Region III sent us a letter dated July 8 pinpointing those issues which had not been resolved at the meetings. Several provisions appear in the May 22 letter which were eliminated in the July 8 letter, but which were brought up again in the October 30 letter as still being problems.5/ This is capricious treatment of the State's efforts. Further, some sections have been said not to have been acceptably modified in the July 30 submittal which were, in fact, modified.6/ Another problem is that, in at least two instances, Illinois has clarified its rules to reflect statements made in court by OSM briefs of counsel, but OSM has chosen to forget those statements and to assert that the Illinois' clarifications render the provisions inconsistent with federal provisions.7/

Because of the failure to adequately review and analyze all of the material that Illinois submitted so that theretofore unresolved problems were clear to both OSM and the State, OSM has failed to assist Illinois in obtaining program approval as required by Sec. 102(g) of the Federal Act.

We note that OSM received a request from the Illinois South Project that the record be reopened for a 15-day public comment on the regulations submitted on July 30 (letter dated July 20, 1980; Record # Ill-0170). If the

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5/ In Part 1845 alone, there are 2 examples: Sec. 1845.2, 10/30 p. 49, 5/22 p/24; Sec. 1845.13(b)(3)(ii)(B), 10/30 p. 50, p. 25.

6/ Sec. 1845.17(b), 10/30 p. 51, 30 day service of assessment.

7/ Sec. 1701.5, 30 CFR 761.5, Definition of Valid Existing Rights, see statement by Al Ghiorzi on Court Transcript of First Round Oral Argument before Judge Flannery, p. 139-140 assuring Judge Flannery that the regulations don't spell out the exclusive determination of valid existing rights; rather it is a site specific concept. However, see Oct. 30 letter p. 54, Finding 22(a). Also Sec. 1823.1, 30 CFR 823.1 OSM's Round 2 Brief stating that the multiple horizon removal and handling regulations only apply to land which will be drilled, blasted or mined. P. 103, n. 13. See Oct. 30 letter, p. 27, Finding 14(a).

lack of public review of final rules was the only reason OSM did not review the rules submitted July 30, it could have been remedied by a reopening of the comment period for 15 days during the many days OSM spent reviewing the submittal. We have noted that the public comment period was reopened for the State of Kentucky, for material that state submitted after the close of the public comment period.[8] It would seem that there would be no reason not to afford Illinois the same treatment for a timely submittal as was afforded Kentucky for a late submittal.

To the extent regulations or other comments were reviewed separately from the Federal Register document, the review is cursory and inconclusive and does not enable Illinois to intelligently prepare a resubmittal. In the letter to me from Walter Heine dated October 30, 1980, the letter states twice that the areas of identified concern are "tentative", which means that Illinois cannot be sure whether what it submits in the resubmittal period will satisfy OSM completely or not, depending upon whether OSM finds additional areas of concern during the resubmittal period. Illinois held two public hearings on the proposed rules it submitted on March 3, and held two meetings with OSM Region III on its concerns with the regulations noted in the May 22 letter. Thus, the regulations submitted to OSM on July 30 deviated from the March 3 submittal almost entirely due to comments from the public and OSM. Our representatives told representatives from OSM during the July 30 meeting at Indianapolis that the rules submitted July 30 were those which were to be promulgated, and that it was those regulations which OSM should review. Nevertheless, OSM spent most of its time reviewing the rules as they were proposed as of June 16. Mr. Heine states in his letter that "OSM has reviewed these proposed regulations, but, due to time constraints, the review was not as complete and thorough as the review of the June 16, 1980, proposed regulations". In addition to wasting its review time on regulations which OSM knew were not the final proposed regulation to be adopted, OSM claims it had inadequate time to review the regulations submitted July 30. However, OSM's regulations only provided for 80 days of review before the initial decision (June 16-September 3); whereas 92 days expired beyond July 30 for review of the Illinois submittal of July 30, since the initial decision was published October 31. OSM took more time to review the regulations submitted on July 30 than their own rules provided, could have taken more if it so desired, and cannot credibly claim a time constraint as the reason for failure to adequately review the very regulations which were revised to answer questions raised by OSM itself and the public. If relief is not granted, Illinois will have had to use a large part of its alloted 60 days to do the work OSM was supposed to have done and point out to your personnel the already resolved "problems" that would have been discovered through a proper review of Illinois' initial submittal. In order to avoid the same type of inadequate review of the resubmittal, which could result in the imposition of a federal program in Illinois, we are asking that you immediately rescind or stay your initial decision and toll the running of the 60 days until OSM has adequately reviewed all material submitted on or before July 30, 1980, and has evaluated the State Act in conjunction with the state regulations submitted on July 30, 1980, which regulations were adopted and transmitted to the Illinois Secretary of State on September 3 for publication in the Illinois register as provided. The regulations must be read to start the running of the 60 days resubmittal time only after an adequate review of a state's original program submittal.[9]

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[8] See Federal Register, Vol. 45, No. 183, 9/18/80, p. 62157.

It is our considered belief that Illinois' submittal of a permanent program was not given proper consideration by your Department. The statement in the Federal Register is clearly incomplete, and several portions of it include arbitrary or capricious decisions, or decisions plainly contrary to the Act. We understand that pressures of work could contribute to this unhappy result. We urge you to use your authority to rescind and reevaluate your initial decision in a manner designed to enable transfer of a state program to Illinois at the earliest practicable time.

We look forward to receiving an immediate reply.

Sincerely,

Brad Evilsizer

Brad Evilsizer
Director

cc: Mr. Walter Heine
Mr. Paul Reeves
Mr. Edgar Imhoff
Mr. David Geyer
(copies available to the Public)

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[9] Illinois also questions whether the 60 days' resubmittal time should in fairness and practice be a strict limitation of a mandatory nature, given OSM's delay of its decision due September 3 by 58 days.

G-8

Senator **Percy**. The record will be left open for the shorter, either 30 days maximum or whenever testimony or questions have been submitted and incorporated that we know are coming.

I know particularly that the League of Women Voters, the National Coal Association, certain other parties have indicated an interest in incorporating testimony into the record. It will be kept open for all those organizations that have officially notified us that they intend to do that.

I would like to thank Secretary Watt, Director Harris and our distinguished panelists for taking time out of their busy schedules to appear before the subcommittee this morning.

We have heard about all the work that presently is being done to reclaim our vital prime farmlands. I have every hope and belief that these efforts will continue.

I am concerned with maintaining the proper balance between increased coal production and optimal agricultural production. To this end, I will continue to monitor closely the activities of the Office of Surface Mining and urge all parties concerned with this problem to continue our dialogue. Such cooperation and understanding is crucial to achieving the goals we all share.

I also would like to thank the subcommittee staff—Jim Aidala, Chuck Pizer, Kathy Froelich, Lynn Lerish, and Bill Strauss—for their outstanding work in preparing for this hearing.

Many thanks to all of you.

The hearing is adjourned.

[Whereupon, at 1:40 p.m., the subcommittee adjourned, to reconvene at the call of the Chair.]

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

STATUS OF PRIME FARMLAND RECLAMATION RESEARCH

AMAX COAL COMPANY

PREPARED BY DAVID S. RALSTON, PH.D., AGRONOMIST

October 19, 1981

Status of Prime Farmland Reclamation Research
AMAX Coal Company
Prepared by David S. Ralston, Ph. D., Agronomist
October 19, 1981

The technology for mining and reclaiming prime farmland is being developed through the joint efforts of the mining industry and university and government researchers. Progress is being made through research programs initiated at the onset of the Federal Surface Mining Control & Reclamation Act of 1977 (Pub. L. 95-87). Test plots have been established in Illinois and Indiana to evaluate limiting factors involved in moving entire farm fields and restoring crop productivity as required by the Act. The primary limiting factors have been identified and mining and reclamation methods are now being evaluated with the goal of minimizing these factors.

Research

University of Illinois agronomists under the direction of Dr. Ivan Jansen are in the fifth year of a 10-year study of prime farmland reclamation. AMAX Coal, Consolidation Coal, Freeman United Coal, Peabody Coal and Southwestern Illinois Coal Companies are funding the $1.7 million program for this vital research. The coal industry is supporting the research due to the unavailability of federal and state funds. The following is a quotation from a Illinois Cooperative Extension Service News release which summarizes work being done on the project. The news release is attached as part of this submittal.

> The researchers are growing corn and soybeans on five sites in southern and western Illinois on mined land that has been reclaimed in different ways to determine the effect on soil productivity.
>
> Soybean yields have ranged from 0 to 41 bushels per acre. Corn yields ranged from 0 to 155 bushels per acre without irrigation and from 142 to 191 bushels under irrigation. The Illinois five-year averages (1976-80) are 35.1 bushels per acre for soybeans and 109.8 bushels an acre of corn.
>
> The lowest yields occurred in 1980 when severe drought and heat stress led to crop failure at some sites, Jansen said. Some of the yield variations also were due to reclamation methods.
>
> Yields on newly reclaimed lands were equal in some instances to undisturbed land but generally they were lower. Jansen noted that in good years they have gotten good yields on reclaimed land but that these crops were more susceptible to weather stress because of the poor physical condition of the newly reclaimed soil, in particular its compaction.

Limiting Factors

AMAX Coal has recognized for some time that compaction is a primary concern in restoring crop productivity of the reclaimed soils. Differential settling resulting in small depressions on the reclaimed surface is another issue which is being studied.

Equipment alternatives are being evaluated for moving the soils in a way that minimizes compaction by traffic on the replaced soil. End-dump trucks have been purchased at one mine to allow placement of the subsoil or root media with minimal compaction resulting from rubber-tired equipment. Scraper traffic has been directed in some locations so that only about one-third of the area is affected during placement of the topsoil.

In addition, AMAX is looking at dragline selective placement and across-pit conveyor systems as a means of moving the unconsolidated materials. Belt systems are being used successfully by other coal operators, and where they are feasible, they provide an excellent way of transferring soils across or around the pit with minimum traffic on the replaced materials.

What can be done to alleviate compaction of reclaimed soil? Mechanical loosening through deep tillage is a logical approach to allow better air and water movement through the soil and deeper root penetration. AMAX has looked at a wide variety of agricultural and industrial-type deep tillage equipment. Hoeboe subsoilers pulled by 4-wheel drive farm tractors are doing an effective job of loosening replaced soils to a depth of about 16 inches. Units have been purchased for all AMAX Midwest operations. In addition, a Murray 5-shank ripper pulled by a Caterpiller D-9 tractor is being used at Leahy Mine for deeper tillage. Its performance is now being evaluted.

Soil compaction is not a unique problem to the mining industry. Farmers using the larger tillage and harvesting equipment are familiar with the problems associated with soil compaction. Perhaps the most promising research on solving soil compaction is being done in Germany. Dr. H. Schulte-Karring of Ahrweiler Institute has spent 20 years developing specialized deep tillage equipment to solve compaction problems for both agricultural and reclaimed soils. He worked in cooperation with engineers at the Kaelble-Gmeinder Company in developing the TLG 12.

The TLG 12, a three-shank soil loosener, has a hydraulically-driven cut-lift system that fractures the soil and then lifts it. The shanks are 45 inches long, allowing a loosening action more than three feet deep. A Howard rotary cutter attached directly behind the TLG 12 prepares a seedbed, allowing direct seeding of grasses and legumes as soon as the soil has been loosened.

The Ahrweiler amelioration technique has been used successfully for surface mine reclamation of prime farmland in the Rhinebraun coal fields in West Germany. Alfalfa is planted initially and provide for deep-root penetration and to help dry the subsoil. After about two years of hay production, the reclaimed soil is deep loosened with the TLG 12. Wheat is planted for one or two years and then the reclaimed soil goes into a normal crop rotation. Crop productivity has been fully restored through the use of the deep soil loosening equipment.

The Kaelble-Gmeinder TLG 12 and rotary cutter are being used successfully in England for surface mine reclamation of cropland. The Ahrweiler amelioration technique is being used in Mexico, Finland, Yugoslavia, Indonesia, North Africa and the Netherlands to solve compaction problems in agricultural fields. At present, there are no units in the United States, but AMAX is considering purchase of a TLG 12 with rotary cutter for use at its Illinois operations starting as early as next summer.

Where differential settling creates surface drainage problems on reclaimed prime farmland, existing agricultural land leveling equipment is available to eliminate the problem. Should small depressions which hold water become apparent, the land leveling equipment could be used prior to deep soil loosening by the TLG 12. The combination of good surface drainage and good internal soil drainage will provide an excellent root zone for crops.

Time Factors

Progress is being made, but, answers to the complex problems associated with moving entire farm fields will take more time than has been allowed to date. "Five years of reclamation research is like three months' work in some other areas, because the effect of time on soil productivity is such a crucial factor," says University of Illinois Agronomist Ivan Jansen. Soils on surface-mined land improve over time with proper reclamation methods. The microbial population, which plays a role in the nutrient uptake and growth of plants, returns to a more favorable balance. Organic matter slowly accumulates and soil structure begins to develop with wetting and drying, freezing and thawing.

To some, the obvious solution to the prime farmland issue is to ban surface mining if 100 percent restoration of crop productivity cannot be guaranteed today. Such a ban on mining prime farmland would eliminate surface mining in the Midwest and significant areas in the eastern states. Draglines and shovels used to uncover coal cannot avoid farm fields. With such a ban, the coal resource underlying prime farmland, which is vital to our nation's total energy needs, could not be recovered by surface mining methods. In most cases, deep mining is not feasible with the relatively shallow coal reserves. This is why it is so important to have sufficient time to develop the technology for mining and reclaiming prime farmland soils to levels which are in line with the intent of Public Law 95-87.

The federal government's efforts have met with industry resistance largely because they have failed to recognize that we are dealing with an emerging science in this area. AMAX believes that reasonable regulations can eventually be achieved for farmland reclamation. AMAX will continue its efforts to convince both federal and state regulatory authorities to adopt regulations and policies that can reasonably be achieved. AMAX has dedicated manpower and resources to assist in developing a surface mining technology that will enable the U.S. coal industry to restore the row crop capability of our nation's prime farmland as quickly as possible following mining.

AMAX Coal Company
Indianapolis, Indiana

NEWS SERVICE
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Source: Ivan Jansen (217/333-3650)
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UI Receives $1 Million To Continue Reclamation Study

URBANA--Federal law requires that the reclamation of prime farmland after surface mining construct soils that are at least as productive as the original soil.

University of Illinois agronomists are trying to make post-mine soils as productive as possible for corn and soybeans. The five-year-old study, which produced its first crop in 1978, is the largest reclamation project for row crops in the nation.

"Five years of reclamation research is like three months work in some other areas, because the effect of time on soil productivity is such a crucial factor," said University of Illinois Agronomist Ivan Jansen.

The scientists will be able to further determine how newly reclaimed soils change over time under a five-year research contract for $1 million from five coal companies: Amax Coal, Consolidation Coal, Freeman United Coal, Peabody Coal, and Southwestern Illinois Coal.

"Surface mining and reclamation are costly and consumers are paying most of those costs. It's important that we protect the productivity of land that is to be surface mined. It is also important that only reclamation methods that are effective be used to give consumers their money's worth," Jansen said.

"It costs more to reclaim surface-mined land than even the best agricultural land is worth. Yet we must protect our future capacity to produce food," he said.

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Reclamation Study—3

Many of the natural soils in western Illinois are excellent and there is no reason to expect that these soils could be improved, Jansen said. The study also is looking at the effects of topsoil replacement.

The researchers are growing corn and soybeans on five sites in southern and western Illinois on mined land that has been reclaimed in different ways to determine the effect on soil productivity.

Soybean yields have ranged from 0 to 41 bushels per acre. Corn yields ranged from 0 to 155 bushels per acre without irrigation and from 142 to 191 bushels under irrigation. The Illinois five-year averages (1976-80)are 35.1 bushels an acre for soybeans and 109.8 bushels an acre of corn.

The lowest yields occurred in 1980 when severe drought and heat stress led to crop failure at some sites, Jansen said. Some of the yield variations also were due to reclamation methods.

Yields on newly reclaimed lands were equal in some instances to undisturbed land but generally they were lower. Jansen noted that in good years they have gotten good yields on reclaimed land but that these crops were more susceptible to weather stress because of the poor physical condition of the newly reclaimed soil, in particular its compaction.

In some cases low yields occurred because of a lack of desirable soil micro-organisms. This problem, which occurs only in the first one to three years, occurs in new soils constructed from a mix of materials that contain little or no material from the natural soil.

Susceptibility to heat and water stress persists longer but at this point researchers cannot say how much longer, he added.

The research plots are located near Astoria, Eads, Marissa, Norris and Percy.

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ENERGY USE AND PRODUCTION: AGRICULTURE AND COAL MINING

by

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For Presentation At
The Land Use Planning Workshop
Conference on Liquid Fuels from Coal and Bio-Mass
at
University of Michigan
October 15-16, 1981

ENERGY USE AND PRODUCTION: AGRICULTURE AND COAL MINING

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ABSTRACT

Many people are concerned that surface mining for coal and other mineral resources is destroying substantial amounts of farmland and should, therefore, be prohibited or severely restrained. Questions are also raised concerning the net amount of energy surface mining for coal yields. Use of land to produce energy crops is urged as a preferable alternative to surface mining. This paper examines the idea and presents comparisons of the true energy cost of farming and mining as ways to produce energy for our use.

INTRODUCTION

A concern often expressed by those opposed to surface mining is that such activity destroys productivity of the land, interferes with the necessary production of food and energy from renewable resources, and, perhaps, even uses more energy than such activity produces. Another idea put forth is that if we would only develop production of energy from bio-mass, we could produce more energy from an acre of farmland than it will yield when mined for coal.

The following information gathered from a number of sources presents facts regarding the amount of energy required to produce crops from average-quality "prime" farmland versus the amount of energy produced and makes some comparisons of these with the amount of energy used and produced by surface mining of such farmland which overlays surface mineable coal.

FARMING

The grain yield of farmland varies considerably and is dependent upon the quality and characteristics of the soil, the amount and kinds of fertilizer applied, the weather including temperature ranges and rainfall, the degree of control methods, and the farming skill exercised in planting, cultivating, and harvesting the crop. For purposes of this study, we shall consider only corn and shall compare three yields: 88, 105, and 157 bushels per acre—all quite possible yields on "prime" agriculture land. The 88-bushel case represents the U. S. average corn yield for the years of 1970 through 1978. The 105-bushel yield represents expectations for properly reclaimed Indiana surface-mined land as estimated by a professor of agriculture at Purdue University, and the 157-bushel yield represents a recent Benton County, Indiana, average for an excellent production year for Indiana's most productive county.

The energy cost of corn (and other grain) production has been studied by several agricultural colleges[1,2,2,4,5], with some differences in results; but recent studies by the Purdue agricultural economics section seem to be most thorough and are used as the basis for most of this report.

Table I shows a listing of a machinery complement, adequate for farming 300 acres of corn per year. The energy costs shown for the various units are based on information supplied by the John Deere Company.

It is estimated that the average useful life of the machinery listed will be ten years. Thus, a total production equivalent is 3,000 acres. During the life of the equipment, repairs will require extra energy equivalent to approximately 25 percent of the original embodied plus fabriacation energy for the complement of machinery.

Tables II, III, IV, and V show the other energy inputs to the corn "crop," and the energy yield based on both grain and the whole plant. At present, only the yield energy represented by the grain is of general use. It is possible that in the future the other parts of the plant may also be used to produce energy in the form of fuel for industrial use, either for direct combustion or as fuel gas produced from the bio-mass of the plant matter by pyrolysis or an aerobic digestion or as alcohol from fermentation.

As can be seen from the data in Tables II, III, and IV, approximately 5 percent of the energy input per acre of corn is accounted for by the energy embodied in producing the materials for the machinery plus the energy used in its manufacture. By far, the largest energy input, 40 to 60 percent, is accounted for by the fertilizer used. As shown in Table V, the energy yield for corn ranges from 4.30 to 5.75 times the input from all sources (ignoring the contribution of the sun and chemical elements present in the soil). For the three cases shown, the net energy yield ranges from 25.27×10^6 to

TABLE I

MACHINERY COMPLEMENT FOR CORN

Item	Wt. in Lbs. Including Tires	Tires Weight Lbs.	Millions of Btu: Embodied Energy Incl. Tires	Millions of Btu: Fabrication Energy	Millions of Btu: Total
Tractor	8,766	650	197.0	51.0	248.0
Combine	12,150	650	273.2	64.3	337.5
Mold Board Plow	2,129	29	57.9	7.8	65.7
Disk	5,664	64	153.9	20.8	174.7
Applicator	4,464	64	121.4	15.8	137.2
Planter	3,224	224	89.4	10.8	100.2
Rotary Hoe	2,164	64	59.2	7.5	66.7
Total	38,561	1,745	952.0	178.0	1,130.0

Sources: Purdue University School of Agriculture
AMAX Coal, Research

TABLE II

CORN PRODUCTION
ENERGY INPUT - RECLAIMED SURFACE-MINED LAND

Input	Units	Btu	
		Per Unit	Per Acre
Fuel - Diesel	5.7 gal	140,000	798,000
Gasoline	3.0 gal	125,000	375,000
Fertilizer			
Nitrogen (N)	120 lbs.	33,333*	3,999,972
Phosphorus (P_2O_5)	50 lbs.	6,032	301,594
Potassium (K_2O)	70 lbs.	4,166	291,643
Seed	23 lbs.	6,339*	145,800
Herbicide - Lasso Aatrex	0.5 gal 0.44 gal	—	498,000
Drying Fuel - Removal of	10% H_2O	—	1,323,300
Electricity	12.8 Kwhrs.	10,000*	128,400
Machinery Components**		—	468,000
Total Input			8,329,709
Yield			
105 bu/acre @ 56 lbs/bu, 6680 Btu/lb.			39,278,400
Ratio - Output/input			4.71

* Energy Used to Produce a Unit
** Based on Table I

Sources: Purdue University School of Agriculture

AMAX Coal, Research

TABLE III

BENTON COUNTY, INDIANA
CORN PRODUCTION ENERGY INPUT, 1975

Input	Units	Btu	
		Per Unit	Per Acre
Fuel - Diesel	5.7 gal	140,000	798,000
Gasoline	3.0 gal	125,000	375,000
Fertilizer			
Nitrogen (N)	148 lbs.	33,333*	4,933,300
Phosphorus (P_2O_5)	69 lbs.	6,032	416,200
Potassium (K_2O)	98 lbs.	4,166	408,300
Seed	23 lbs.	6,339*	145,800
Herbicides - Lasso and	0.5 gal	--	
Aatrex	0.44 gal	--	498,800
Drying - Removal of	10% H_2O		1,978,600
Electricity	19.2 kwhrs	10,000*	192,000
Machinery Component**			468,000
Total Input			10,214,000
Yield			
157 bu/acre @56 lbs/bu, 6680 Btu/lb.			58,730,560
Ratio - Output/input			5.75

* Btu Required to Produce a Unit
** Based on Table I

Sources: Purdue University School of Agriculture

AMAX Coal, Research

TABLE IV

U. S. AVERAGE CORN PRODUCTION
ENERGY OUTPUT

Input	Units	Btu	
		Per Unit	Per Acre
Fuel - Diesel Oil	5.7 gal	140,000	798,000
Gasoline	3.0 gal	125,000	375,000
Fertilizer			
Nitrogen (N)	112 lbs.	33,333*	3,733,308
Phosphorus (P_2O_5)	31 lbs.	6,032	186,988
Potassium (K_2O)	60 lbs.	4,166	249,980
Seed	19 lbs.	6,339*	120,443
Herbicides - Lasso	0.5 gal		498,800
Aatrex	0.44 gal		
Drying - Removal of	10% H_2O		1,109,000
Electricity	10.8 kwhrs	10,000*	107,600
Machinery Component**			468,000
Total Input			7,647,119
Yield			
88 Bu/acre @56 lbs/bu, 6680 Btu/lb.			32,919,040
Ratio - Output/input			4.30

* Energy Used to Produce a Unit
** Based on Table I

Sources: Purdue University School of Agriculture

AMAX Coal, Research

48.52 x 10^6 Btu per acre for the grain. If we assume that the entire corn plant can be used, the net energy yields range from 77.38 x 10^6 to 141.52 x 10^6 Btu per acre.

Corn grain can be used as power plant fuel, as proven in 1977 by a number of tests in which it was fired as supplemental fuel in pulverized coal-fired boilers. However, such use is not ordinarily economically attractive. So the energy contained in corn will be made available to man directly as food or, after conversion, to meat when fed to cattle, hogs and fowl or as alcohol for gasahol and other alternate fuel uses.

As the price of petroleum fuels increases and availability becomes less certain, interest in the production of alcohol from corn and other agricultural materials has grown to significant levels. A number of fuel grade alcohol plants have been and are being built to supply a new market for alcohol as a gasoline extender. Commercial gasahol in the U. S. is currently a blend of 10 percent 199 proof ethyl alcohol in gasoline.

Putting aside the ethical question of using a food crop for energy, the use of corn as an energy crop via alcohol production modifies the energy output per acre calculations shown in Tables II, III and IV to give new net yield numbers shown in Table VI. These calculations were made using information on the energy requirements of the corn to alcohol process developed in a private multi-client study of the production of fuels from bio-mass made by Stanford Research Institute[6]. Table VII shows the principal energy flow information from which the net energy yield calculations were made.

As you can see from Table VI, the net energy production is reduced substantially if corn is converted to alcohol. Net energy yield per acre is reduced 60 to 65 percent by introducing the alcohol conversion process into the energy output/input ratio. The average acre of corn that had a net energy increase of 25.27 x 10^6 Btu with an output/input ratio of 4.30 to 1 has a net energy yield of only 9.48 x 10^6 Btu with an output/input ratio of 1.44 to 1 when the end product is alcohol made from the corn.

This loss in energy production is not necessarily bad. In fact, it is customary. When we convert fossil energy to electricity we lose about two-thirds of the energy the original fuel contained. Conversion of energy from one form to another form judged to be more useful is believed to be worth the cost in the case of oil, gas, coal or nuclear energy to electricity. It is likely that conversion of solid energy forms such as coal or wood or oil shale or bio-mass (in the case, corn) to a liquid fuel suitable for uses now met by petroleum products will be judged as worth the loss in energy experienced in the conversion processes.

TABLE V

OUTPUT/INPUT ENERGY
CORN PRODUCTION

	Millions of Btu		
	Yield 88 Bu/Acre	Yield 105 Bu/Acre	Yield 157 Bu/Acre
Btu/acre of grain	32.92	39.28	58.73
Input, Btu/acre	7.65	8.33	10.21
Net yield, Btu/acre	25.27	30.95	48.52
Ratio, energy output/ energy input	4.30	4.71	5.75
Yield, whole plant Btu/acre	85.03	101.47	151.73
Net yield, whole plant	77.38	93.14	141.52
Ratio, energy output/ energy input	11.12	12.18	14.86

Sources: Purdue University

AMAX Coal, Research

TABLE VI

OUTPUT/INPUT ENERGY - CORN/ETHANOL

(Btu in millions)

	Yield 88 Bu/Acre	Yield 105 Bu/Acre	Yield 157 Bu/Acre
Gal. Alcohol/acre (grain only)*	220	262.5	392.5
Yield Btu/acre	18.656	22.260	33.284
Distillers Dry Solids** Btu/acre	12.474	14.884	22.255
Total Yield Btu/acre	31.100	37.144	55.539
Energy Input:			
To produce grain Btu/acre	7.65	8.33	10.21
To make alcohol			
Coal, Btu/acre**	9.174	10.946	16.367
Elec., Btu/acre**	2.200	2.625	3.925
To Dry Distillers Solids**	2.596	3.098	4.632
Total Energy Input Btu/acre	21.620	24.999	35.134
Net Yield, Btu/acre	9.48	12.145	20.405
Ratio Output/Input	1.44	1.49	1.58

* 2.5 gal./bushel
** From Table VII

TABLE VII

PRINCIPAL ENERGY FLOW: CORN TO ETHANOL

	Btu/gal Ethanol
Input	
Feedstocks	
Corn	150,500 (37,000)*
Coal	41,700
Electricity	4,500 (13,200)*
Total input	196,700
Output	
Products	
Ethanol (199 proof)	84,100
Fuel oil	700
By-products	
Distillers dry grains	56,700 (11,800)*
Rejected heat and losses	55,200
Total output	196,700

---

* Fossil fuel energy required for production

Source: AMAX Coal, Research (Private Report SRI)

We can avoid the ethical question referred to earlier by using the waste products; i.e ., the stalks and shucks instead of the grain as the bio-mass base for alcohol production. However, currently available processes to convert high cellulose materials into forms suitable for fermentation reactions are more expensive and energy intensive than processing grain to produce alcohol.

A further penalty on use of plant materials is the need to return a substantial portion of such materials to the land to help maintain necessary levels of organic materials in the soil. If conversion of only half of the stover to alcohol could be done at the same energy cost as grain to alcohol, net alcohol yield would be increased to 15.37×10^6 Btu per acre; and in addition, the grain would be available for food and feeder uses. The proportionately larger net yield in such a case is due to charging the alcohol process with only one-half of the farming energy attributable to growing the stover and assuming stover growth represents 62 percent of the total crop energy input. Where as in the grain to alcohol conversion, the entire crop input energy cost is charged to the process since no other energy output is used or available for use as an energy source.

Other energy crops than corn have also received attention. Sunflower oil[7] and soybean oil[8] as substitutes for diesel oil have been studied by several investigators. Production of plants which produce a sap high in hydro-carbons, gopher weed, Euphorbia lathyris, for example, is also under study[9]. This particular plant latex sap has a heat content of 17,000 Btu per pound and yields 10 to 20 barrels per acre of refined oil for a total energy production of 50 to 100 million Btu per acre or about the same amount as the average acre of corn if we could use the whole plant as a source of energy.

MINING

For purposes of comparison of the energy input and yield values for alternate land uses, we have made a study of Midwestern surface mining, using a southern Indiana surface mine as an example.

Table VIII shows the average complement of machinery for the mine with calculated energy values represented in that machinery. The energy used in operations was that experienced in a typical production year. We have added a machinery component based on certain assumptions on the life of the machinery, and the energy cost of repair over the life of the machinery. These data are given in Table IX.

Obviously, the production in tons of coal per year from a given coal deposit will vary for a given machinery complement, being greatly

TABLE VIII

MINING MACHINERY COMPLEMENT
SOUTHERN INDIANA SURFACE MINE, 1976

Item	Number	Total Mfg. Energy Btu x 10^9*	Btu/Ton of Coal**
Dragline - 8950	1	395.0	6,283
Lima - 2400	1	12.2	203
Haulage trucks plus Water truck, sprinklers and refuse trucks	20	67.7	3,385
Service trucks	12	1.7	283
Pick-up trucks	33	3.8	633
Tractors, Front end loaders and motor graders	21	45.2	7,533
Shovels	3	65.0	1,083
Overburden drills	4	15.1	203
Scrapers	10	51.9	5,190
Total		657.6	25,906

* Total manufactured energy is the sum of energy of manufacture plus embodied energy in the material and was estimated from weights of equipment.

** Estimated from equipment life ranging from 3 to 30 years for various equipment and assumes production of 2 million tons per year.

Source: AMAX Coal, Research

TABLE IX

ENERGY USED IN COAL PRODUCTION AT A SOUTHERN INDIANA MINE, 1976

Input	Btu Used/Ton of Coal Produced
[1]Diesel oil	63,297
[2]Gasoline	4,791
[3]Electricity	175,014
[4]Other fossil energy forms	2,521
[5]Explosives (Anfo)	74,600
Machinery component	25,906
Total	345,238

Energy yield/acre 6,300 tons/acre at 22×10^6/tons	149.6×10^9 Btu
Energy input/acre	2.348×10^9 Btu
Net energy yield/acre	147.25×10^9 Btu
Ratio - Energy output/energy input	63.7
Equivalent energy produced used in production	1.57%

[1]Diesel oil	138,690 Btu/gal	
[2]Gasoline	124,952 Btu/gal	
[3]Electricity	10,000 Btu/Kwhr	- energy used to produce 1 Kwhr
[4]Other	138,690 Btu/gal	
[5]Explosives (Anfo)	19,000 Btu/lg.	- energy used to produce 1 lb.

Source: AMAX Coal, Research

dependent on the depth and character of overburden, thickness of coal seam or seams, efficiency of the operating crews, weather, environmental regulations, topography, and the skill of the management.

As can be seen from the data in Table IX, the energy yield ratio, that is, energy output divided by energy input, is approximately 64 to 1. For every 100 tons of coal produced, we use the energy equivalent of 1.6 tons of coal for that production, including the energy required to make all of the materials used in the machinery, as well as the energy required to fabricate that machinery. That part of the total energy used accounts for only 7.5 percent of the total energy used in mining this coal.

LAND USE AND ENERGY PRODUCTION

An interesting comparison of the energy use and production from mining and farming of "prime" agricultural land can now be made, using the data presented in the sections on farming and mining.

One acre of typical southern Indiana land mined for the coal will show a net production of energy of 147 billion Btu (at 6,800 tons per acre). This same land with good reclamation and proper fertilization should produce a net of about 31 million Btu as corn (93 million Btu for the whole plant), based on Purdue University calculations.

The ratio of coal energy net yield per acre to corn energy net yield is either 4742 to 1 for grain, or 1580 to 1 for whole plant energy. This means that even at the lowest ratio the land will have to be farmed for almost 1600 years to produce the same net total amount of Btu that mining yields.

Other areas with higher or lower coal yields will have different ratios of coal-to-corn energy production, but even with a low yield of 2,500 tons of coal per acre we obtain at the one Illinois mine, the ratios would be 1743 to 1 and 581 to 1.

An additional factor that must be considered when we make judgments on the question of surface mining of coal which underlays crop land, is the amount of idle or unused farmland in the U. S. today. For fifteen of the last twenty years the U. S. Department of Agriculture has had some sort of program of set aside, or otherwise diverted from production, crop acreage which idled from 12.9 million (1979) to as much as 58.7 million acres (1972) of feed grain, wheat and upland cotton[10].

Surface mining of all kinds has interrupted potential agricultural production on a total of approximately 6 million acres through 1977[11-12]. Much of this acreage, particularly the 1.7 million acres disturbed by coal mining, has been or is being returned to productive use. However, just since 1965, 16.3 million acres of land have been permanently removed from the potential agricultural resource base by urban sprawl, highways, shopping centers, airports and the like. In addition, another 6.6 million acres were inundated by water[13-14].

In view of the very long periods of time required for equivalent energy quantity production, the loss of farm production for the few years required for mining and reclamation to full productivity is a very small price to pay for the tremendous amounts of energy recovered in surface mining for coal. Furthermore, those persons in our society who are truly concerned with the conservation of the land as one of our most basic of resources, should express that concern, not about an interim use of the land such as surface mining for coal, but about those permanent uses which forever preclude use of the land for food and fiber production.

REFERENCES

1. Doering, Otto C. "An Energy Based Analysis of Alternate Production Methods and Cropping Systems in the Corn Belt" NSF/RA-770125 June 1977. Agricultural Experiment Station Purdue University, West Lafayette, Indiana.

2. Doering, Otto Co. "Accounting for Tillage Equipment and Other Machinery in Agricultural Energy Analysis" NSF/RA 770128 June 1977. Agricultural Experiment Station, Purdue University, West Lafayette, Indiana.

3. Doering, Otto C. Private communication, "A General Procedure for Counting Energy In Farm Machinery" May 1978.

4. Keener, Harold M. and Roller, Warren L., "Energy Production by Field Crops" Paper No. 75-3021, American Society of Agricultural Engineers Annual Meeting June 22-25, 1975.

5. Buchele, Wesley F. "Harvesting and Utilization of Cornstalks from Iowa Farms" Report No. 3 June 1975, Agricultural Engineering Department, Iowa State University, Ames, Iowa.

6. SRI - "Fuels From Bio-mass" - Private Multi-client Study - Report No. 19, Energy Technology Economics Program, May 1981.

7. Hoffman, Vern et. al., "Sunflower Oil as a Fuel Additive," Cooperative Extension Service, North Dakota State University, Fargo, North Dakota.

8. Erickson, David R. and Dixon, Parry, "Soy Oil as Diesel Fuel," American Soybean Association, St. Louis, Missouri.

9. Krohe Jr., James, "Growing Oil" Across the Board, July/August 1981.

10. U. S. Department of Agriculture, "1973 Set Aside Programs Annual Report."

11. U. S. Department of Agriculture, "The States of Land Disturbed by Surface Mining in the United States," Basic Statistics as of July 1, 1977. Soil Conservation Service, SCS-TP-158.

12. U. S. Bureau of Mines, "Land Utilization and Reclamation in the Mining Industry, 1930-71," I.C. 8642, 1974.

13. Lee, Linda K., "A Perspective on Cropland Availability," U. S. Department of Agriculture, Economics, Statistics, and Cooperative Services. Agricultural Economic Report No. 406, July 1978.

14. "Surface Mining: Soil, Coal and Society," A Report Prepared by the Committee on Soil as a Resource in Relation to Surface Mining for Coal; Board on Mineral and Energy Resources, Commission on Natural Resources, National Research Council. Published by National Academy Press, Washington, D.C., 1981.

Written Statement of

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Presented to:

Senate Government Affairs Committee
Energy, Nuclear Proliferation and
Government Processes Subcommittee

October 22, 1981

Washington, D. C.

Consolidation Coal Company (Consol) appreciates this opportunity to comment on surface coal mining and reclamation in Illinois. Consol's Midwestern Region is headquartered in Evansville, Indiana with operating offices in Cadiz, Ohio and Pinckneyville, Illinois. Consol's Illinois operations consist of one underground mine in southcentral Illinois, near Coffeen, Montgomery County and four surface mines in southern Illinois in Jackson, Perry and Randolph Counties. A fifth surface mine in northcentral Illinois, at Norris in Fulton County, was recently closed because of depressed market conditions.

Consol's average annual coal production in Illinois, between 1975 and 1980, was 8,178,000 tons; a sizeable portion of Illinois' approximate 60 million ton per year total coal production. Consol's average annual personnel count in Illinois during this same six year period (1975-1980) was 1,800 employees. Consol obviously has considerable interest in the development and implementation of Illinois' surface mining regulatory program.

The fixed nature of Illinois' land resource and the concurrent diversified interests of recreational, urban and industrial development has created land use conflicts and popularized a host of related terms including land use planning, rural revitalization and "prime" farmland. Prime farmland is that land which has a combination of soil and climatic conditions most conducive to plant growth.

Much has been said recently about the loss of America's prime farmland and topsoil resources. This loss is quite real; however, when one examines the reasons for prime farmland diversion in Illinois, losses to mining account for a very small percentage of the total. Much more pronounced is the appropriation of prime farmland by recreational, rural and subdivision expansion, and commercial/industrial interests. (Economic Research Service, USDA) Furthermore, under today's standards the mining of agricultural land is only a temporary land use diversion. Subdivisions, commercial development and recreational facilities are permanent land use alternatives; they cannot be returned to production.

The primary reason for concern over the loss of prime farmland is the accompanying loss of valuable topsoil. Detailed design criteria within the federal surface mining regulations govern the removal, stockpiling and replacement of the A soil horizon and even the subsoil horizons. During mining and reclamation precautions are taken to prevent soil loss incidences and their occurence is usually quickly corrected. Ironically, one only has to drive north from Springfield along Illinois Highway 55 to observe some of the most serious losses of topsoil from intensive row crop farming and improper soil management occurring with little or no regulatory intervention. Consol acknowledges the validity of the Federal Acts' concern for protecting prime farmland -- our reservations in this matter only go to the appropriateness of the measures of protection required up to and including a total ban on mining.

Consol is greatly disturbed by extremists who advocate the abolition of mining on all agricultural lands. This narrow-minded approach to land use grossly underestimates the same scientific technology that has made America a leader in world food production. Many of these extremists actually have little or no formal scientific training in the biological sciences. Even fewer numbers have any technical knowledge of the engineering practices and problems encountered in everyday mining and reclamation operations.

Portions of both the Federal Surface Mining Control & Reclamation Act and accompanying federal regulations were specifically designed to accommodate the unique conditions that characterize the mining and reclamation of Illinois' prime farmlands. The regulations require comparable pre- and postmining productivity levels. To accomplish this end, the law allows for the "best technology currently available." Consolidation Coal Company views this reclamation challenge as an integral part of our Illinois mining process. In 1976, concern for the proper restoration of Illinois productive farmland prompted Consol and several other coal companies in the state to initiate an intensive reclamation research study with the University of Illinois. Industry made numerous unsuccessful attempts to elicit government support and involvement in the Illinois research project. Plot construction was completed in 1977 prior to the signing of the Act. Today Consol's reclamation research activities have expanded into a variety of postmining land uses including additional in-house row crop plots, forestry, fish and wildlife habitat and orchard establishment. Consol recognizes that there have been past and the ongoing problems associated with reclamation. We have met this challenge by establishing Environmental Quality Control departments in each Operating Region. In particular, our Illinois staff consists of trained biologists, agronomists, foresters, horticulturists, soil scientists, wildlife biologists, engineers and personnel of other environmentally-related disciplines. Many of these employees are also part-time farmers, fishermen and avid outdoor enthusiasts -- people who value our land resource second to none.

The number of cooperative research projects in Illinois is impressive. The previously mentioned University of Illinois study was designed to examine the productive capacity of postmined prime farmland. Five participating coal companies, including Consol, contributed approximately $700,000 to the project during the first five year (1977-1981) cycle. General trends based on results from the first five-year cycle are available. However, university investigators feel that the second five-year term is essential to meaningful results and specific conclusions. Beginning in 1982, a second five-year cycle will be funded by industry at an estimated cost of $1,420,000.

At Southern Illinois University, a reclamation research greenhouse study was recently completed by Consol at an approximate cost of $17,000. This project, which focused on subsoil blending of forest-formed soils in southern Illinois, demonstrated the benefits of B and C horizon mixing. In addition to enhancing soil physical properties and increasing soil productivity, reclamation costs can be reduced by subsoil blending. In 1979, Argonne National Laboratory began plot construction at Consol's Burning Star #3 mine in southern Illinois to evaluate selected overburden materials and management techniques on surface mined agricultural lands. During the six year expected lifetime of the experiment, it is estimated Consol will have contributed more than $500,000 in on-site services.

Consol also recognizes the importance of forestry, fish and wildlife habitat and fruit production in southern Illinois where the forest-formed soils, climate and topography are conducive to a variety of land uses other than row crops.

To address these concerns. Consol has entered into cooperative wildlife studies with Southern Illinois University and the University of Illinois. In-house reforestation studies on reclaimed land have been established at several of Consol's southern Illinois mines and a small in-house orchard reclamation project at Burning Star #5 mine was developed in 1980.

We would also like to take a few moments to express our general dissatisfaction and concern with the recently published Office of Surface Mining prime farmland grandfathering rules (46F.R.47720-2). The surface mining industry is essentially no better off under these rules than it was under those proposed by OSM on January 23, 1981. Our pleas that existing mines and continuation of existing mines be grandfathered have not been heard. Our arguments based on the opinion of the U.S. Court of Appeals for the District of Columbia Circuit (May 2, 1980) and the statements noted in the Senate Report on the Surface Mining Act have been totally disregarded.

In the Court's opinion the existing surface mining provisions of the grandfather exemption must apply to continued operations of ongoing mines, yet the September 29, 1981 rule essentially applies the exemption only to those areas permitted as of August 3, 1977. Regardless of rulemaking on the federal level, the grandfather exemption will stop in Illinois on August 3, 1982 in accordance with the Department of Mines and Minerals policy. The new rules' extension of the exemption to renewal or revision areas or to other parts of the original permit are window dressing and provide no real benefit to the coal industry. Indeed, one only has to read the definition provided for "renewal," "revision" and "single continuous surface coal mining operation" to realize the non-applicability of this exemption to most surface mining operations. Consol, after reading these rules, fully expects to lose all grandfathering priviledges in 1982. This certainly was not the intent of the Surface Mining Act. Consol believes that the grandfather exemption should extend to all lands associated with mines permitted as of August 3, 1977.

In closing, I would like to emphasize Consolidation Coal's full willingness to accept the double responsbility of effective reclamation and efficient coal production. To accomplish both these tasks simultaneously, however, industry must be allowed to utilize our technical and practical field-based experience while operating within the guidelines of the law. A total ban on the mining of prime farmland is absurd. Such a step backward would merely serve to sharply curtail America's economic growth and energy independence. Food and energy are both important Illinois resources. Multiple land uses to develop these resources is not only possible, it is essential to healthy state and national economies. Industry's intense involvement in reclamation research stems from the realization that many problems await solutions. Land reclamation is a young science. Whatever these studies reveal, industry's time, effort and financial investment should be recognized.

WRITTEN STATEMENT

BY

JOSEPH S. SPIVEY, PRESIDENT
ILLINOIS COAL ASSOCIATION

BEFORE THE
SENATE GOVERNMENTAL AFFAIRS COMMITTEE
ENERGY NUCLEAR PROLIFERATION AND
GOVERNMENT PROCESSES SUBCOMMITTEE

OCTOBER 22, 1981

My name is Joseph S. Spivey and I am President of the Illinois Coal Association, the trade organization representing the coal industry in Illinois.

My testimony covers comments from most of our member companies and thus expresses their views.

My comments are listed in the following three general areas:

1. Surface mining -- prime farmlands and grandfathering.
2. Underground mining and prime farmlands.
3. Summary.

As you must know, the ICA and its member companies view the prime farmland regulations as some of the most critical as it affects Illinois operations.

1. Surface mining -- prime farmlands and grandfathering.

Let me begin by expressing the philosophy of our members as well as by attempting to publicly dispel a myth which seems to surround the thinking of some people. Our philosophy on operations in Illinois is that we, as operating companies, have a responsibility and an obligation to return surface mined land to beneficial and productive use. This responsibility did not suddenly appear with the creation of PL 95-87 or OSM, but has been a gradual and orderly transition due to increasingly stringent Illinois laws and regulations. Such regulations have not been complied with at no or at little cost; the cost per ton of coal is rising as the cost of reclamation goes up. Society wants better reclamation and the coal industry can accomplish such reclamation so long as a viable market for our product exists.

THE MYTH I REFERRED TO ABOVE GOES LIKE THIS: IF A PLOT OF LAND IS GRANDFATHERED BY REGULATION OR LAW, THAT PLOT OF LAND DOES NOT HAVE TO BE RECLAIMED, OR IT WILL BE RECLAIMED IN A SIGNIFICANTLY INFERIOR WAY. THIS IS SIMPLY NOT TRUE -- ESPECIALLY IN ILLINOIS. GRANDFATHERING A PLOT OF LAND ALLOWS AN OPERATOR TO MINE WITHOUT PROVING THAT HE CAN RECLAIM THE LAND TO SPECIFIC PRODUCTIVITY LEVELS BEFORE MINING. IT DOES NOT EXCLUDE HIM FROM RECLAMATION OR REVEGETATION OR ANY OF THE OTHER ENVIRONMENTAL STANDARDS. IN ADDITION, GRANDFATHERING EXEMPTS THE OPERATOR FROM A MANDATORY B AND C SUBSOIL SEGREGATION. IT DOES NOT EXEMPT HIM FROM TOPSOIL REMOVAL OR REPLACEMENT OR GRADING REQUIREMENTS OR PROOF OF PRODUCTIVITY.

GRANDFATHERING IS A TIME-TESTED METHOD USED BY REGULATORS AND BY CONGRESS TO ENSURE THAT THOSE PERSONS WHO HAVE COMMITTED LARGE SUMS OF MONEY IN ANTICIPATION OF OPERATING IN A KNOWN WAY NOT BE THROWN INTO A "CATCH 22" SITUATION. IT IS A TRANSITIONAL TOOL TO ALLOW TIME TO RECOVER INVESTMENT. THE NEW MINE OPERATOR KNOWS WHAT HE IS GETTING INTO AND CAN PLAN HIS FINANCIAL OUTLAY ACCORDINGLY. SIMPLY PUT -- THE NEW MINE OPERATOR CAN DECIDE WHETHER HE WANTS TO MINE AT ALL; THE EXISTING OPERATOR HAS COMMITTED HIMSELF FOR THE LIFE OF THE MINE BY LAND, EQUIPMENT AND IN MANY CASES, LONG TERM CONTRACTS.

IF GRANDFATHERING LAND WERE TO ALLOW FOR CALLOUS DISREGARD FOR STANDARDS OR WOULD RESULT IN VASTLY INFERIOR RECLAMATION, WE WOULD HAVE TO EXAMINE THE OPTION CLOSELY. AS I HAVE SAID, WE DO NOT BELIEVE THIS IS THE CASE AT ALL; ESPECIALLY WHEN ONE CONSIDERS RULES SUCH AS ILLINOIS RULE 1104.

THE ICA BELIEVES THAT THE INTENT OF PL 95-87 WAS TO ALLOW GRANDFATHERING OF LAND FOR AS LONG AS NECESSARY, AND WHEREVER NECESSARY, TO ALLOW OPERATORS TO COMPLETE AN ORDERLY MINE PLAN OPERATION. THIS VIEW WAS STRENGTHENED BY THE U.S. COURT OF APPEALS, DISTRICT OF COLUMBIA, DECISION ON MAY 2, 1980. THE COURT IN THAT DECISION COULD NOT HAVE BEEN MORE POINTED IN ITS DECISION.

I FEEL COMPELLED TO LAY A FOUNDATION BY QUOTING FROM THE COURT DECISION AT FOOTNOTE 18:

> "OUR DISPOSITION OF THIS ISSUE REFLECTS THE RECOGNITION OF CONGRESS IN SECTION 510(D)(2) OF THE ACT THAT WHEN THE STATUTE WAS ENACTED, EXISTING OPERATORS ON PRIME FARMLANDS HAD ALREADY MADE LARGE INVESTMENTS IN RELIANCE ON THE REQUIREMENTS IN EFFECT AT THE TIME AND THAT SUCH EXISTING MINES SHOULD CONTINUE IN OPERATION INDEPENDENT OF THE FORTUITOUS NATURE OF THE STATES' PERMIT MACHINERY."
> (EMPHASIS ADDED)

THE ICA COULD NOT VOICE ITS OPINION BETTER OR MORE CLEARLY.

THE 1982 CUT-OFF DATE FOR GRANDFATHERED LAND IS ARBITRARY, UNREASONABLE AND INCONSISTENT WITH FEDERAL LAW.

TO TRY AND SET A SPECIFIC DATE FOR ALL OPERATIONS IN THE NAME OF "ORDERLY TRANSITION" OR "CERTAINTY OF SCOPE" IS TO IGNORE THE FACT THAT SURFACE MINING OPERATIONS ARE SITE SPECIFIC, ARE DEPENDENT ON SIZE OF OPERATIONS AND ARE AFFECTED DIFFERENTLY BY THE REGULATIONS.

For example, consider two mining operators which are identical except for the size of their draglines. Operator "A", for example, can mine far greater acreage under a grandfather clause than can operator "B", simply because in the past one operator decided to purchase a large dragline. This simple illustration points out the absurdity of trying to cut off a legislatively mandated exemption at a date certain.

Certain situations may warrant a grandfather clause terminating earlier than August 1982 and others later than 1982. That decision must be made on a case-by-case basis and should be made by the regulatory authority.

-- Re-stating Senator McClure's statement (123 Cong. Rec. S12, 442) as quoted by the U.S. Court of Appeals --

> "The exclusion will apply to continued operation of an on-going mine beyond the acreage and time covered in the existing permit at the time of the enactment of the Act, just so long as the continuance does in fact constitute continued operation of an on-going mine." (Emphasis added)

The ICA fails to see even a hint of a cut-off date in that statement. The intent was clearly to grandfather an operational situation, rather than a chunk of time.

2. UNDERGROUND MINING AND PRIME FARMLANDS.

THE UNDERGROUND COAL MINING INDUSTRY IN ILLINOIS DOES NOT QUESTION THE NEED NOR ITS RESPONSIBILITY TO RECLAIM, FOR CONTINUED BENEFICIAL USE, THE AREAS AFFECTED BY ITS ACTIVE SURFACE OPERATIONS. IN ADDITION, THE INDUSTRY HAS CONSISTENTLY SUPPORTED THE CONCEPT OF TITLE IV OF THE FEDERAL SURFACE MINING ACT (PL 95-87) TO PROVIDE FUNDS TO REPAIR THE ENVIRONMENTAL DAMAGE DONE DURING LESS ENVIRONMENTALLY ENLIGHTENED TIMES. THE INDUSTRY IS ALSO WELL AWARE AND ACCEPTS ITS LEGAL RESPONSIBILITIES TO CONTROL AND MITIGATE ADVERSE EFFECTS OF SUBSIDENCE ON SURFACE LAND IN STRUCTURES TO THE EXTENT TECHNOLOGICALLY AND ECONOMICALLY FEASIBLE.

WITHOUT IMPAIRING THIS COMMITTEE'S ACCEPTANCE OF THE SINCERITY OF THE ABOVE STATEMENTS, WE NOW MUST POINT OUT THAT THE APPLICATION OF OSM'S PRIME FARMLAND REGULATIONS TO SURFACE AREAS OF UNDERGROUND MINES EXCEEDS THE CLEAR INTENT OF CONGRESS AS EXPRESSED IN SECTION 510(D)(1) AND 515(B)(7) OF PL 95-87. IN ADDITION, THIS APPLICATION OF OSM'S RULES IS BOTH UNREASONABLE AND IMPRACTICAL.

THAT CONGRESS DID NOT INTEND PRIME FARMLAND REGULATIONS TO APPLY TO LAND THAT HAD NOT BEEN ACTUALLY MINED IS MADE CLEAR IN ITS SELECTION OF WORDS TO DESCRIBE LANDS AFFECTED BY MINING ACTIVITY. THROUGHOUT THE ACT, WHEN REFERRING TO SURFACE DISTURBANCES ACCOMPANYING ALL ASPECTS OF COAL MINING, THE DRAFTERS OF THE ACT USED THE PHRASES "SURFACE COAL MINING AND RECLAMATION OPERATIONS" OR "SURFACE COAL MINING OPERATIONS". SIGNIFICANTLY, THE PRIME FARMLAND DIRECTIVES OF SECTIONS 510(D)(1) AND 515(B)(7) OF THE ACT ADDRESSED ONLY "LANDS TO BE MINED".

It is clearly unreasonable to apply the prime farmland reclamation standards to the surface work areas of underground mines when one appreciates the very small land areas so affected. For a typical large underground mine in Illinois the ratio of surface disturbed area to the area in which coal is extracted is on the order of 1 to 30. In the larger sense of the total farmland in Illinois, it becomes even more unreasonable to apply the costly prime farmland reclamation standards to surface work areas of underground mines. A detailed 1977 survey for the Illinois Institute of Environmental Quality showed that in Illinois a total of 10,468 surface acres had been affected by underground mining in the 100-year history of the industry. Compare this acreage with the approximately 95,000 acres of Illinois farmland converted every year to non farm purposes for non mining related reasons. It is significant, we believe, that the recently published National Agricultural Land Study includes neither surface mining nor underground mining as significant contributors to the problem of conversion of agricultural lands to non agricultural uses. The August 1981 USDA publication Coal Development in Rural Areas, The Resources at Risk concludes that "... any loss in agriculture production because of mining would not be serious nationally or regionally ..." The Conservation Foundation in its 1930 publication Future of American Agriculture as a Strategic Resource states that "It is not possible to defend an argument that coal production poses a threat to food supply."

AGAIN, WE EMPHASIZE THAT WE ARE NOT SUGGESTING THAT FARMLAND AFFECTED BY SURFACE MINING OPERATIONS SHOULD NOT BE PROPERLY RECLAIMED. WE ARE SUGGESTING, HOWEVER, THAT THE IMPOSITION OF BURDENSOME PRIME FARMLAND RECLAMATION STANDARDS ON THE SURFACE WORK AREAS OF UNDERGROUND MINES IS FIRING THE EMOTIONALLY CHARGED CANNON OF PRIME FARMLAND PRESERVATION AT A TARGET THAT IF HIT DIRECTLY WILL NOT SIGNIFICANTLY AFFECT THE WAR ON FARMLAND CONVERSION.

LASTLY, IT IS CLEAR THAT THESE REGULATIONS ARE IMPRACTICAL WHEN APPLIED TO THE SURFACE WORK AREAS OF UNDERGROUND MINES. IN ILLINOIS, LARGE RESERVES OF COAL MAY BE ENTIRELY OVERLAIN BY PRIME FARMLAND MAKING IT NECESSARY TO DISTURB A SMALL PORTION OF SUCH FARMLAND TO GAIN ACCESS TO THE RESERVES IF THE COAL IS TO BE MINED AT ALL. THE MAJORITY OF SURFACE DISTURBANCE ASSOCIATED IN MODERN, LARGE UNDERGROUND MINES IN ILLINOIS IS FOR THE PURPOSE OF STORING WASTE REMOVED FROM THE RUN OF MINE COAL IN COAL PREPARATION PLANTS. (HOWEVER DESIRABLE, EXISTING TECHNOLOGY AND SAFETY CONSIDERATIONS DO NOT ALLOW THIS WASTE MATERIAL TO BE RETURNED UNDERGROUND.) IT IS NOT PRACTICAL TO RESTORE ALL SUCH WASTE DISPOSAL AREAS TO CROPLAND PRODUCTION AND YET SECTION 785.17(D)(1) APPEARS TO ALLOW NO EXCEPTION TO THE REQUIREMENT THAT THE APPROVED POSTMINING LAND USE OF PRIME FARMLAND MUST BE CROPLAND. THIS REGULATION, AS OSM HAS WRITTEN IT, COULD EFFECTIVELY PROHIBIT UNDERGROUND MINING IN AREAS IN WHICH NO NON PRIME FARMLAND IS PRACTICALLY AVAILABLE FOR THE DISPOSAL OF COAL MINE WASTE.

IN ADDITION, BY MAKING ABSOLUTE THE PROHIBITION OF PRIME FARMLAND CONVERSION, OSM HAS PRECLUDED THE USE OF RECLAIMED SURFACE WORK AREAS FOR UNDERGROUND MINES AS IMPORTANT WILDLIFE ENHANCEMENT AREAS. SUCH AREAS CAN SERVE AS IMPORTANT DISPERSION CENTERS FOR WILDLIFE IN PARTS OF ILLINOIS WHERE MODERN FARMING PRACTICES DURING THE PAST FEW YEARS HAVE DECIMATED WILDLIFE HABITAT.

ONCE AGAIN, WE DO NOT TAKE ISSUE WITH THE NEED TO STRONGLY DISCOURAGE CONVERSION OF OUR VITALLY IMPORTANT AGRICULTURAL RESOURCES. WE DO BELIEVE THAT THE ABSOLUTE PROHIBITION OF CONVERSION OF PRIME FARMLAND AFFECTED BY MINING TO OTHER ENVIRONMENTALLY ACCEPTABLE BENEFICIAL PURPOSES MAKES NO MORE SENSE THAN AN ABSOLUTE PROHIBITION FOR SUCH CONVERSION BY ANY OTHER OF MAN'S ACTIVITIES.

3. SUMMARY.

IN CLOSING, THERE ARE JUST A FEW FACTS THAT SHOULD BE MENTIONED, SUCH AS THE FOLLOWING:

THERE ARE ROUGHLY 23 MILLION ACRES OF PRIME FARMLAND IN ILLINOIS AND OF THIS, THE U.S. SOIL CONSERVATION SERVICE HAS ESTIMATED THE LOSS OF ILLINOIS PRIME FARMLAND AT 95 TO 100 THOUSAND ACRES ANNUALLY. IN 1980 ILLINOIS COAL PRODUCERS SURFACE MINED APPROXIMATELY 4300 ACRES, ALL OF WHICH WILL BE PUT BACK INTO FULL PRODUCTIVITY. QUESTION -- WHAT HAS HAPPENED TO THE OTHER 95,000 ACRES OF PRIME FARMLAND? IT IS OBVIOUS THAT THIS LAND HAS BEEN DESTROYED FOREVER, EITHER BY URBANIZATION OR SOIL EROSION. THE NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS, IN ITS RECENT STUDY, STATES THAT THE

UNITED STATES IS LOSING 3 MILLION ACRES ANNUALLY TO URBANIZATION AND YET ANOTHER 3 MILLION ACRES TO FARM EROSION -- MAINLY DUE TO FALL PLOWING, WIND AND WATER EROSION.

ALSO, AS MENTIONED ABOVE, NOT ONE SINGLE REPORT OR STUDY HAS EVEN HINTED OR EVEN SUGGESTED THAT THE COAL INDUSTRY AT PRESENT OR IN THE FUTURE WILL HAVE ANY SIGNIFICANT EFFECT ON PRIME FARMLAND THAT HAS BEEN SURFACE MINED.

IN ESSENCE, IN THE MODERN DAY COAL INDUSTRY WE LOOK UPON OURSELVES AS TEMPORARY STEWARDS OF THE LAND BEFORE, DURING AND AFTER MINING. BUT YET, ALL OF THE SO-CALLED ACTIVIST GROUPS IN ILLINOIS AND THOSE THAT ARE PRESENT HERE TODAY WOULD HAVE THIS COMMITTEE BELIEVE THAT WE ARE PERMANENTLY DESTROYING THE LAND. WE QUESTION THEIR MOTIVES -- WE QUESTION THEIR SINCERITY. AND WE SINCERELY HOPE THAT YOU WILL DO THE SAME.

I WOULD LIKE TO THANK YOU FOR HAVING THE OPPORTUNITY TO PRESENT THESE WRITTEN COMMENTS FOR THE OFFICIAL RECORD.

# # #

PEABODY COAL COMPANY'S
COMMENTS ON PROPOSED REGULATIONS
ON PRIME FARMLANDS GRANDFATHER
(30 CFR 716 and 785)
FEDERAL REGISTER, APRIL 16, 1980, PP 25992-25995

A. Fundamental Principles Relating to Prime Farmland Grandfather Clause

With the promulgation of its April 16 proposed regulations, the Office of Surface Mining ("OSM") is now embarked upon its third attempt to implement the prime farmland grandfather clause within § 510 (d)(2) of the Act. Each effort has seemed to thwart the clear intent of Congress as evidenced by the unambiguous language of § 510 (d)(2). The latest proposal compels us to emphasize once again the following simple and basic principles underlying the grandfather clause.

1. The typical surface coal mining operation is designed to follow along a coal seam or seams which, in many instances, may take up to several decades to mine. Substantial investments in equipment and land are made before mining begins, and the coal to be produced from that seam is often sold in advance, under long-term requirements contracts.

2. Section 510 (d)(2) confers grandfather protection against the Act's special prime farmlands requirements for three types of operations. It provides [with numeration of the clauses added]:

> "Nothing in this subsection shall apply [1] to any permit issued prior to the date of enactment of this Act, [2] or to any revisions or renewals thereof, [3] or to any existing surface mining operations for which a permit was issued prior to the date of enactment of this Act."

3. As has been spelled out in some detail in the litigation challenging OSM's grandfather regulations, the purpose of this provision was to protect coal operators who had already made commitments on the basis of existing law from the

imposition of what was viewed as an especially stringent new set of requirements. As with grandfather clauses in general, this exemption was based on the concept that you don't change the rules in the middle of the game.[1] The three different aspects of § 510 (d)(2)'s grandfather clause were intended to guarantee that this protection would be given equitably to ongoing mines in all the states, regardless of technical differences among the state permit procedures in existence before the Act was passed. Thus the second clause of § 510(d)(2) eliminated the differences between states that issued permits for the "life of the mine" and those that issued permits for specific shorter periods, but allowed renewals or revisions that would cover the entire mining operation. The third clause was added to take account of states with short permit periods and with no provisions for renewals or revisions.[2]

B. OSM's Attempts to Define Section 510(d)(2)

The interim program regulations issued by OSM played havoc with this carefully developed scheme by omitting the third clause of the grandfather provision.[3/] The anomalous result was that the application of the prime farmlands provisions would depend on the technicalities of the pre-Act state permit system, the very situation Congress had sought to avoid.

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[1] See, e.g., United States v. Carolina Carriers Corp., 315 U.S. 375 (1942).

[2] Senator Bayh stated:

> "'As originally introduced, this exemption from a special review process would have treated Indiana inequitably, because under Indiana State law technically there are only new annual permits and no renewals, even though operators meeting the conditions of their permit routinely get a new or renewed permit upon application.
>
> "'I was very gratified that the author of the prime farmland amendment, my distinguished colleague, Senator Culver of Iowa, modified his prime farmland amendment at my suggestion, to give on-going Indiana stripping operations the same protections afforded operations in other States despite the unusual procedures mandated by our State's law.'"
> 123 Cong. Rec. S8802 (daily ed. May 26, 1977).

After withstanding an attack on its interim regulation in the District Court, In re: Surface Mining Regulation Litigation, 452 F.Supp. 327 (D.D.C. 1978), OSM went on in its permanent program regulation on the prime farmland grandfather clause to nullify the second clause of the statutory provision.[4/] Faced with challenges that this further restriction was not only contrary to the statute but also inconsistent with the agency's own interim regulation, OSM withdrew this regulation and on April 16 put forward its new proposal. While the new proposed regulation goes some distance toward implementing all three clauses of the statutory provision, it imposes new restrictions on the scope of the grandfather clause (e.g., placing an absolute time limit of August 3, 1982 on all three of § 510 (d)(2)'s grandfather

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[3/] Section 716.7(a)(2) provides:

> "Permits issued before that date [August 3, 1977] and revisions or renewals of those permits need not conform to the provisions of this section . . .
>
> "Permit renewals or revisions shall include only those areas that--
>
> (i) Were in the original permit area or a mining plan approved prior to August 3, 1977; or
> (ii) Are contiguous and under State regulation or practice would have normally been considered as a renewal or revision of a previously approved plan."

[4/] Section 785.17(a) of the regulations provided:

> ". . . . Areas where mining is authorized under permits issued or mining plans approved prior to August 3, 1977, are exempt from the prime farmland reconstruction standards."

exemptions and limiting the exemption for existing operations to lands which the operator had a legal right to mine on August 3, 1977). These new limitations have absolutely no foundation in the plain language of the Act or its legislative history. Moreover, a recent decision by the U.S. Court of Appeals for the District of Columbia Circuit not only struck down OSM's interim grandfather regulation because it failed to give effect to all three clauses of the statutory provision, but, as we show in great detail below, in the process eliminated the foundation on which the newest restrictions were constructed.

A statement we made in our brief challenging the initial interim program grandfather regulation is obviously still true now: it is entirely clear that the Secretary does not like the grandfather exemption for prime farmlands. No more, a third of a century ago, did the I.C.C. like the grandfather entitlement to motor carrier certificates of public convenience and necessity. The words of the Supreme Court in U.S. v. Carolina Carriers Corp., 315 U.S. 475 (1942), are equally applicable here:

> "Congress has made a grant of [grandfather] rights . . . . Neither the Court nor the Commission is warranted in departing from those standards because of any doubts which may exist as to the wisdom of following the course which Congress has chosen." 315 U.S. at 489.

Again, the awesome responsibilities of the Secretary do--

> "not mean that the right to the statutory grant may be withheld or cut down because the Commission disapproves of the competitive [here, environmental] conditions which may be created if the application is granted."
> Id. at 481.

We show below that the arbitrary cut-off date of August 3, 1982 must now be rejected by the Secretary if he is prepared to accept that the Congress has conclusively determined the issue.

C. The Court of Appeals Opinion

The Court of Appeals in In re: Surface Mining Regulation Litigation, No. 78-2190 (D.C. Cir., May 2, 1980) invalidated OSM's attempt to eliminate the third clause of § 510(d)(2) in its interim regulations. Judge Robb's opinion establishes that the third category of operations mentioned in the statute--" any existing surface mining operations for which a permit was issued prior to the date of enactment of this Act"--must be given "meaning apart from the first two" by being "interpreted, as the Surface Miners contend, as grandfathering existing surface mining operations which are based on a pre-enactment permit but which were neither explicitly covered by the permit nor any renewal or revision thereof." (Slip Op. at 30.) The Court recognized that the purpose of the third category was to prevent technicalities such as short permit terms or the absence of renewal or revision procedures in some states from frustrating the Congressional intent of "assur[ing] continued operation of ongoing mines." Slip Op. at 28-29. As the Court explained:

> ". . . . Our disposition of this issue reflects the recognition of Congress in section 510(d)(2) of the Act that when the statute was enacted, existing operators on prime farmlands had already made large investments in reliance on the requirements in effect at the time and that such existing mines should continue in operation independent of the fortuitous nature of the states' permit machinery." (Slip Op. at 31 n.18.)

The Court of Appeals found, then, that the Congress, when it enacted § 510(d)(2), felt that it would be inequitable to apply the prime farmlands requirements to one operator simply because his state calls permission for the continued operation of an existing mine a "new" permit, while another operator is exempted because his state calls substantially the same thing a "renewal" or "revision" of an existing permit. Such differences in terminology were held to be irrelevant to the interests Congress sought to protect--not changing the rules in the middle of the game.

In short, the Court embraced the interpretation of the grandfather provision offered on the Senate floor: "the exclusion will apply to continued operation of an on-going mine beyond the acreage and time covered in the existing permit at the time of the enactment of the Act, just so long as the continuance does, in fact, constitute a continued operation of an ongoing mine." Slip Op. at 29, quoting 123 Cong. Rec. S12,442 (daily ed. July 20, 1977) (statement of Sen. McClure affirmed by Sen. Metcalf).

The Court definitively rejected the legislative history and arguments that have been consistently relied on by OSM as the basis for all its restrictions on the scope of the prime farmland grandfather regulations, including the new restrictions proposed for the first time on April 16. OSM's argument from the legislative history has hinged on a single statement by Congressman Tsongas, concurred in by Congressman Udall, indicating that the grandfather clause was not intended to bestow "the right of contiguous or noncontiguous expansions that were not specified or authorized in the originally approved and grandfathered permits." 123 Cong. Rec. H7588-89 (daily ed. July 21, 1977). The Court dismissed Congressman Tsongas' statement with the following comment:

> "The statement of Congressman Tsongas directly conflicts with other indications in the legislative history of the development of the grandfather exemption and also contradicts the express words of the statute insofar as he omits reference to permit 'revisions or renewals'. We believe that the interpretations of the grandfather clause expressed in the Senate are better evidence of its true meaning than the inconsistent pronouncements in the House because the prime farmland grandfather rights included in the Surface Mining Act originated in the Senate, where the explanations of the exemption were coherent and compatible." Slip Op. at 29.

The Court was similarly unpersuaded by the claim that some "meaningful limitation on what constitutes a continuance of an ongoing mine" was necessary to prevent extravagant claims that mining on"an entire portion of a State" constituted continuances of a single ongoing mine "even though 'it was not originally contemplated that the area[s] would be part of the same mine.'" (Slip Op. at 31, quoting Br. for Appellee Secretary of Interior at 77 & n.79.) Finding such anxiety "unfounded," the Court concluded that "the Surface Miners' interpretation of the grandfather clause [to cover "the continued and contiguous operation of the same ongoing mine along its seam"] is reasonable and in keeping with the intent of Congress." Id.

When the regulations proposed on April 16 are examined in light of the Court of Appeals decision, two points become clear. First, there is no longer any question that the third category mentioned in the statute (and by implication the second as well) must be given its appropriate significance in the regulations. Second, the reasons offered for the novel restrictions on the scope of the grandfather clause in the proposed regulations now lack substance because the grounds for imposing them have been rejected by the Court.

D. Statutory Language and Legislative History

The regulations proposed on April 16 would allow the grandfather exemption to "apply only to lands mined to the coal face and related benches prior to August 3, 1982." § § 716.7 (a)(2)(v), 785.17(a)(5), 45 Fed. Reg. 25995. Significantly, OSM has cited nothing in the statute to support this cut-off, nor has it found any direct support in the legislative history other than Congressman Tsongas' discredited comments. Indeed, § 510(d)(2) by its terms is inconsistent with such a cut-off in that it provides:

> "Nothing in this subsection shall apply to any permit issued prior to the date of enactment of this Act, or to any revisions or renewals thereof, or to any existing surface mining operations for which a permit was issued prior to the date of enactment of this Act." (Emphasis added.)

Congress expressly chose these words after considering various alternative methods of structuring the transition to compliance with the prime farmlands provisions. The provision finally enacted contains no absolute limit on the time an ongoing operation may continue to be exempt from the prime farmland requirements. This is not because Congress was unaware of this issue. Indeed, in the Conference Committee discussions, Congressman Seiberlin expressed concern about the language that was eventually enacted because of the substantial length of time and area that would be affected:

> "I must say that I think some sort of limitation is needed, particularly as long as renewals are in there. I have just been handed an estimate of the prime agricultural land to be affected by surface mining in Indiana.
>
> "On Amax Mines alone, they will be able to continue mining up to 27 years if renewals of existing permits is included and would affect a total of 19,000 acres of prime agricultural land which would be exempt from the provisions of this section.
>
> "I think we did more than we should have done and we need some sort of limitation." Conference Committee Transcript, June 29, 1977, at 25, quoted in Legislative History Supplement to Joint Brief for Appellants, D.C. Cir. Nos. 78-2190-2192 (Jan. 30, 1979), at 91.

In response to this concern, other members of the committee suggested eliminating the coverage for renewals or placing a 90-day limit on the exclusion. Eventually, however, the Committee decided to adopt the language passed by the Senate without change. The Conference Report explained the grandfather proviso as follows:

> "The Senate amendment contained a special test, effective on the date of enactment, with respect to the protection of prime farmlands . . . . Permits and coal surface mine operations existing on the date of enactment would not have to meet this test."
>
> * * * *
>
> " . . . . The exclusion for existing mines, permit or renewals thereof after the date of enactment was also agreed to by the Conferees who desired to assure continued operation of ongoing mines. . . ." H. Rep. No. 95-493, 95th Cong., 1st Sess. 105. (Emphasis added.)

In the face of the clear words of the statute, Congress' express rejection of any time limit on the grandfather clause, and its support of the concept of "continued operation of on-going mines" (now endorsed by the Court of Appeals), the proposal to limit the effect of the grandfather provisions to mining that takes place before an arbitrarily chosen date 5 years after the passage of the Act is clearly unlawful. The capriciousness of this proposed limitation becomes even more apparent when one examines, as we do below, the source of the idea and the weakness of the purported justifications for it.

E. Source of the Cut-Off Date Concept

As the April 16, 1980 proposed regulations make clear (45 Fed. Reg. 25994), the August 3, 1982 cut-off date originated in a decision of the Illinois Department of Mines and Minerals, In re: Southwestern Illinois Coal Corp. (The Captain Mine), No. RA 78-1 (Oct. 19, 1978). In this opinion the Illinois Department was struggling to make sense, in the context of Illinois regulatory practice, of an Illinois rule based on the OSM interim grandfather clause regulation, which has since been struck down by the Court of Appeals.[5/] The fact that the OSM-inspired Illinois rule had eliminated the third clause of the statutory grandfather provision posed a dilemma for the Department. On the one hand, it was clear to the Department that the ongoing mine operation involved should be exempt from the prime farmlands requirements on the ground that it was, in the words of § 510(d)(2), an "existing surface mining operation [] for which a permit [had been] issued prior to August 3, 1977." Id. at 11.[6/] Yet, the Department also recognized that the rule, like the OSM regulation, seemed effectively to nullify these words by limiting the scope of the exemption to areas "which under state law or regulation, or practice, normally would have been considered a renewal or revision of a previously approved mining plan." Since Illinois regulatory procedure made no provision for "renewals" or "revisions" of permits, the regulation on its face seemed to make the grandfather exemption inapplicable.

To deal with the apparent inconsistency between the Act and the regulation, the Department focused on the word "practice" in the regulation and developed a two-pronged

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5/ Section 7.2 of the Illinois Emergency Regulation, quoted at p. 5 of the Department's opinion, is essentially identical to 30 C.F.R. § 716.7(a)(2).

6/ The facts found by the Department included the following: The areas to be mined touched and bordered on each other; They were to be developed as part of the same pit; the coal mined from them would use the same coal processing plant; the state Environmental Protection Agency had issued a single permit in 1976 covering all the areas; the coal to be mined was contained in the same two continuous coal seams; the mining operation had begun in 1964 and had continued to the present; the company had declared in a signed inspection report in 1964 that the estimated life of the mine was 50 years; a long-term contract for delivery of coal from this mine until 1994 was in effect before 1977; and the company had documented support showing investment of capital and property indicative of an intent to engage in long-term development of the coal vein, including the subject area. In re: Southwestern Illinois Coal Corp., No. RA 78-1, at pp. 4-5, 7.

position designed to bring some measure of equity to the situation in Illinois while paying homage to OSM's position (which the Department noted had at that time been sustained by the District Court) that without some extra limitation beyond that contained in the statute, "Congressional intent would be violated since mining might otherwise extend indefinitely." *Id.* at 12.

The Department first held that the requested exemption should be granted because "Illinois *practice* clearly contemplated the issuance of the permit subject to the present exemption request." *Id.* at 12 (emphasis added). But, in an apparent attempt to placate the federal regulators, the Department then stated that, as a matter of the same state "practice" that had allowed this exemption, it intended to "limit exemptions to a period of 5 years from August 3, 1977, (which is the same period as a federal permit) and to areas contiguous, for mining purposes, with pre-August 3, 1977, mining operations." *Id.* at 13. *The concept of a single arbitrary cut-off date was thus the product of an attempt to cope with the elimination of the third clause of the statutory grandfather provision*. Once that clause is allowed its intended significance (as is now the case after the decision of the Court of Appeals), the reasons that generated the cut-off concept disappear completely.

It is therefore highly ironic that in the same proposed April 16, 1980, regulation that finally recognizes the significance of the third clause of the grandfather provision, OSM should attempt to adopt the cut-off date concept which was created only because of OSM's earlier refusal to recognize the third clause. Indeed, OSM would now impose the arbitrary August 3, 1982 cut-off date on *all* mines, *even those in states that issue permits or renewals for the life of the mine*.

Even before the Court of Appeals decision such rewriting of the statute was unsupportable. While OSM in its preamble offered an argument to that end, the Court of Appeals decision has eliminated its foundation. The problem that spawned this novel cut-off concept--OSM's nullification of the third category of exempt mining operations--has been finally resolved by the Court's reaffirmation of the terms of the statute. Moreover, the passage of legislative history relied on for the earlier nullification and also for this proposed limit has been authoritatively discredited.

F. The Purported Justifications

OSM's entire argument for the 1982 cut-off date is founded on that now familiar single passage of legislative history, the statement of Congressman Tsongas (concurred in by Congressman Udall). This is the only real authority cited in support of the cut-off date in the preamble (the District Court opinion relied on the same passage and the Illinois Department opinion relied in turn on the District Court opinion). The Court of Appeals' authoritative rejection of this passage and of the argument based upon it, see pp. 6-7, supra, should put this attempted justification to rest once and for all.

Building upon Tsongas' statement, the preamble offers several subsidiary justifications. For example, the preamble argues that the cut-off date "carries out Congress' intent to insure an orderly transition from the pre-Act to the post-Act standards by allowing operators a reasonable period to meet the new standards," and that it is necessary to prevent mining "from continuing indefinitely beyond that time needed in which operators can compile the information and make the showing required by the Act." 45 Fed. Reg. 25994. These arguments misconceive the purpose and structure of Section 510(d)(2). The section is not designed to provide existing operations with the time necessary to comply with the prime farmlands provisions. Rather, the Act states simply that the special prime farmland protections shall not apply to the three categories of operations it lists. As the Court of Appeals noted, the purpose of the grandfather provision was to protect those who had "already made large investments in reliance on the requirements in effect at the time." Slip Op. at 31 n.18. Congress chose to achieve this goal in the most direct fashion, by applying the new requirements only to those mines that were not already permitted or ongoing at the time the Act was passed. It expressly rejected alternatives that would have eliminated protection from "renewals" or would have placed a specific cut-off date on the grandfather provision. See pp. 8-9, supra. Instead, Congress chose to exempt "the continued operation of an ongoing mine . . . just so long as the continuance does, in fact, constitute a continued operation of an ongoing mine." [7/]

The preamble then makes the remarkable contention that the cut-off date will eliminate the "potential of wide variations between States" and the accompanying "competition in interstate commerce" that would allegedly undermine state regulatory efforts, and that it "gives certainty to both the public and the operators about the scope and extent of the grandfather clause." 45 Fed. Reg. 25994. We find these arguments quite ironic, since the potential for wide variations, competition, and uncertainty were introduced by OSM's own refusal to implement all three clauses of the statutory provision in the first place. The tripartite scheme established by Congress, which the proposed regulations at last accept and which the Court of Appeals has now reaffirmed, was specifically designed to avoid these problems without the use of any arbitrary cut-off date. Indeed, the proposed alternative offered by the industry elsewhere in

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7/ Slip Op. at 29, quoting 123 Cong. Rec. S12442 (daily ed. July 20, 1977) (Sen. McClure).

these comments demonstrates that none of these problems is inherent in the scheme enacted by Congress. OSM clearly cannot now justify imposing a cut-off date by claiming it is necessary to cure problems which were caused by its own resistance to the Congressional scheme and which should come to an end now that OSM's restrictive regulations have been stricken.

G. Effects of the August 3, 1982 Cut-Off Date

The proposed cut-off date is not only unnecessary to achieve Congress' purpose, it would actually frustrate the intent of the grandfather provision. While Congress intended to exempt the continued operation of ongoing mines, the August 3, 1982 cut-off date would end the exemption for many ongoing mines long before the mines are scheduled to cease operations. For example, of the Midwestern mines operated by Peabody Coal Company that came within the coverage of the grandfather provision as of August 3, 1977, over 90% are projected to be in continued operation beyond 1982.

Contrary to Congress' desire to protect "existing operators on prime farmlands [who] had already made large investments in reliance on the requirements in effect at the time," Slip Op. at 31 n.18, this premature termination of grandfather protection would subject Peabody and other operators to the burdensome costs of compliance with the prime farmland requirements in connection with operations in which they had made substantial investments prior to August 3, 1977. For example, at the mines referred to above, which are subject to these requirements, the total capital expenditure in facilities and equipment prior to August 3, 1977 was over $115,000,000.

H. The "Legal Right to Mine" Limitation

Although the proposed regulation belatedly recognizes the third clause of the statutory provision by exempting existing operations, it continues to reflect the Secretary's resistance to Congressional intent by placing unjustified restrictions on the scope of that part of the exemption. The most serious of these limitations is the requirement that an operator must have "had a legal right to mine the land prior to August 3, 1977, through ownership, contract, or lease but not including an option to buy, lease or contract." § 716.7(a)(2)(iii)(b). The preamble makes no attempt to explain why this limitation was included.

Any such explanation would have been difficult, since there is not a word in the statue or its legislative history that confines the grandfather exemption to lands where there was on August 3, 1977 a "legal right to mine . . . but not including an option . . . . "

Even more importantly, this proposed limitation would frustrate the basic purpose of the grandfather provision--the protection of investments made in reliance on prior law--because it ignores the reality of how mining operations are conducted. Mine operators seldom purchase all the land they desire to mine before they begin mining. The normal practice is to purchase enough to get started and to stake out a claim by purchases (often in checkerboard fashion) in the remainder of the mine area. The remaining unpurchased lots (referred to as "windows") are then picked up over time as necessary or when the price is right. On the other hand, the operator normally makes a major investment in equipment (draglines, shovels, coal hauling trucks, coal preparation plant) at the beginning of the mining operation with the intention of using this equipment for the duration of the mine.[8] The cost of this equipment is substantial, even in relation to the cost of the land to be mined. For example, a single dragline can cost $25,000,000 and a coal preparation plant can cost $50,000,000, while the price of coal in place is currently only about $1.20 per ton (and was only about $.03 per ton as recently as 1968). Furthermore, given the pattern in which land is often purchased and the impracticality of applying the prime farmland provisions in a patchwork fashion, the investment in land that has already been made is not practically severable from the additional investment that must be made to complete the mining operation.[9]

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[8] This is even more true in the case of underground mines, where initial start-up costs, such as the construction of the mine shaft, are quite significant and are fixed in nature.

[9] The exclusion of "options" is also peculiar in light of actual practices. Long-term options are not common. Rather, options are usually employed only to preserve the terms of an agreed-upon purchase for the short period necessary to work out the details of closing. The existence of an option is therefore strong evidence that the land was intended to be in the mine and that commitments have already been made to purchase it.

I. Application of Prime Farmland Standards to Underground Mines

The United States District Court for the District of Columbia, In re: Permanent Surface Mining Regulation Litigation, Civil Action No. 79-1144 (May 16, 1980) suspended the application of 30 CFR Part 823 to underground mining, and suggested that the Secretary promulgate an exemption from Part 823 for surface facilities at underground mines that are actively used over extended periods but which affect a minimal amount of land. If such regulations are promulgated they must recognize the inherent differences between surface and underground mines and not attempt to apply standards designed for actual surface mining areas to the surface facilities for underground mines. We agree with the comments of Mr. Joseph Spivey of the Illinois Coal Association at the public hearing conducted by OSM in Springfield, Illinois on May 15, 1980. It is obviously impractical to apply prime farmland standards to coal refuse areas which will represent only a small portion of the area to be mined.

In addition, to the extent if any, that underground mines may be subject to the prime farmland performance standards they must be eligible for grandfathering in the same manner as surface mines.

J. Suggested Revision

It is respectfully suggested that 716.7 and 785.17 as proposed be modified by deleting from 716.7 all language commencing with the subparagraph (iii) of (a)(2) to the end and deleting from 785.17 all language commencing with the subparagraph (3) of (a) to the end and inserting in lieu thereof the following language (paragraph numbering based on 716.7)

(iii) Lands that encompass an existing surface mining operation (including underground mines) for which a permit was issued for all or any part thereof prior to August 3, 1977. The determination that such lands are excluded from the application of § 716.7 shall be made by considering all relevant factors as to what constituted an existing surface coal mining operation (including underground mine) which include but are not limited to:

(a) A map showing the geographical location of the area for which the determination is requested and the area previously affected by the mining operation.

(b) Information concerning the contractual coal sales commitments for that mining operation which may include the dedication of reserves to a customer.

(c) Maps and/or other documents which identify the location and extent of land or mineral rights control. Also, information relating to the extent of the geographical area in which the operator had acquired or attempted to acquire coal lands or rights.

(d) Mining plans, maps or other documents which identify the area intended to be mined during the life of the mining operation.

(e) Maps or other documents identifying the extent of coal exploration activity performed in the area.

(f) Copies of any other operational authority issued by governmental agencies, including, but not limited to, permits, mining licenses, MSHA identification numbers.

(g) Evidence of the legal and financial commitments made by the applicant in connection with the mining operation.

(h) Information on mine conditions and levels of production of the mine, including the productive capacity of the mine equipment.

(i) Information regarding the size, continuity and composition of the mine labor force.

(j) All other information, including, but not limited to, sworn affidavits, which might be used to determine the extent of the geographical area which the operator intended to mine.

Provided further, in making the foregoing determination, no one or group of factors shall be controlling nor shall the absence of information pertaining to one or more of the factors be a justification for determining that the lands are not exempt. Such determination shall be made based upon the relevant factors of the particular operation for which the determination is sought.

(iv) In submitting the information described in (iii) above the applicant may identify and mark confidential such information which in the opinion of the applicant is proprietary and would not be subject to release under the terms, conditions and criteria set forth in the Freedom of Information Act. The Regulatory Authority shall then treat such information so identified as confidential and proprietary.

(v) In requesting a determination of exemption as provided in (iii) hereof an applicant may submit such information for the remaining projected life of the mine or any part thereof. The resultant determination shall then be applicable and effective for all subsequent permits issued for said existing surface coal mining operations (including underground mines) or part thereof.

JUSTIFICATION

Justification for the proposed modification is premised primarily on the discussion above critiquing the proposed 716.7 and 785.17 modifications. In addition, the proposal itself speaks with authority on the topic.

The essential question presented to the regulatory authority in determining a grandfather is what geographic area was incorporated in an existing mine on August 3, 1977. This question can best be resolved by ascertaining the operational capability of that mine. It must be kept in mind that each mine is somewhat unique. However, the generalized subjects of information pertaining to surface mines (and surface effects-underground) will assist the regulatory authority in resolving this question.

An example of the information which might be considered by a regulatory authority is attached hereto as Appendix A and incorporated herein by reference. Your attention is directed to the first page of the attachment which describes Peabody's Homestead Mine operation in Kentucky. This material was compiled as a result of an existing grandfather issue pending before a Kentucky State Court. Kentucky as the regulatory authority denied the grandfather premised on the regulation voided by the Circuit Court of Appeals.

The credibility of the informational submissions can little be doubted. Coal mine operators enter into Coal Supply Agreements, prepare mine maps, conduct exploratory drilling, make legal and substantial financial commitments on the basis os conducting their business and not for any ulterior purpose. In point of fact, most of the information submitted will have been prepared long before SMCRA was even contemplated and certainly before Prime Farm Land requirements were incorporated in the legislation. Thus in determining the parameters of the existing mines, ascertainment may be comfortably made with this type of information.

While we may be accused of being overly generous in light of the Court of Appeals' decision (Supra), Peabody is of the opinion that the criteria outlined to be used to evaluate the ultimate question presented to the Regulatory Authority is the fairest interpretation of the exemption clearly and unequivocally granted by § 510(d)(2) of the Act.

Stanley Zellmer, Deputy Program Director, Land Reclamation
Program, Argonne National Laboratory

Prime Farmland Reclamation Research Progress and Needs

Current estimates indicate that as much as 45% of the strippable coal reserves in the Midwest lies beneath prime farmland used principally for row crop agriculture. The performance standards promulgated by the Office of Surface Mining in response to the federal Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87) address this problem. The prescribed method for returning lands to row crop production is the segregation, stockpiling (if necessary), and reapplication of the soil surface layers (the A and B horizons). These regulations reflect the assumption that the soil horizon materials must be removed and reapplied for successful future row crop production. The intent is to preserve the physical, chemical, and biological characteristics of the root zone material. However, typical soil handling procedures at midwest surface mines result in major alteration of the soils' physical and biological makeup. A limited number of prime farmland reclamation research projects are underway, but practical, proven methodologies must still be developed for achieving full productivity.

One prime farmland research effort at the Burning Star Mine No. 3, located on Consolidation Coal Company property in Randolph County, Illinois, is being conducted by the Land Reclamation Program based at Argonne National Laboratory and funded by the U.S. Department of Energy. The goals of this project are to examne in detail the environmental and economic problems associated with the restoration of soil productivity on surface mined agricultural lands to to provide methods, at reasonable cost, for the return of these lands to acceptable levels of row crop production. The project has developed an integrated research plan that includes field, laboratory, greenhouse, and economic studies.

Preliminary results from field investigations indicate compaction of the subsoil is a major factor in limiting crop production on newly constructed minesoils. The loss of soil structure and increased bulk density, resulting from the reapplication of soil materials by earth-moving equipment, prevent normal soil water movements and crop root development. The resultant reduction in the water infilration rate increases surface runoff and leads to excessive erosion rates. Subsoil compaction increases water stress and limits nutrient uptake by row crops, therefore reducing crop yields. Because mining companys have large capital investments in equipment, new and improved mechanical (subsoilers or rippers) and biological (special deep rooted crops) methods must be developed to reduce subsoil compaction over a shortened period of time.

An important but overlooked factor in land reclamation is the role of the soil microbial community. This unseen ecosystem controls the cycling of nitrogen and carbon, governs the availability of phosphorous, and contributes to the development of a stable soil structure. The stockpiling of topsoil, a normal surface mining practice, alters the makeup of the soil microbial community. Long-term studies have been started to investigate the reestablishment of the microbial community in minesoils, but additional studies are needed to determine the effects of various management practices on this ecosystem and the potential for inoculation of areas undergoing reclamation.

Topsoiling is a costly operation in mined land reclamation. This operation is neither the only nor the best alternative available in all cases. As one Southern Illinois farmer said "What topsoil we haven't worn out, we let wash away in the 200 years people have been farming in this part of the country - why save it?" Long term crop management studies now underway should be continued to determine the cost effectiveness of "creating" a new topsoil for minesoils. The use of special deep rooted, high biomass producing crops can be grown to decrease subsoil bulk density and develop a new surface soil superior to the original topsoil.

Greenhouse investigations comparing various subsoil material from Southern Illinois show no significant differences in crop production. This indicates subsoil materials selection should be based on economics of excavation and reapplication. Standard agronomic analyses results of these subsoil materials are not closely correlated with expected crop response. This suggests that minesoil analytical techniques need to be improved as to more accurately predict crop production.

A major objective of the Burning Star project is not only to evaluate the environmental effectiveness of the treatments but also to determine their cost effectiveness. This study indicates the total cost of earthmoving and associated costs for an average acre, graded to PL 95-87 standards, to be about $25,000. About $6,000 or over 23% of that cost is for topsoil removal and reapplication. Over $10,500 per acre or 42% was spent to replace subsoil, while grading of the overburden totalled about $6,400/acre or 25% of the total cost. These data indicate that $22,500/acre or 90% of the cost is for moving soil and overburden. To reduce the overall reclamation costs for prime farmlands, new and less costly means of moving earth must be developed or successful, exceptable reclamation must be accomplished without the removal and reapplication of topsoil and subsoil. The Burning Star project is investigating a few of the many possible ways to accomplish this type of prime farmland reclamation.

In any discussion of current reclamation research and future research needs, two important points must be noted. First, any area can be reclaimed with unlimited funds and second, coal companies are profit-oriented. Currently, most of the reclamation costs are passed through to the consumer. The real research needs are to develop successful methods that can be used to reclaim prime farmland at an acceptable costs. Our nation must develop coal as an energy resource and conserve its prime farmlands, but it must all be done at a price we can afford. This can only be accomplished by continued federal support of long-term reclamation research.

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October 16, 1981

Honorable Charles Percy
United States Senator
Dirksen Office Building
Chicago, Illinois

IN RE: Hearing on Energy and Governmental Regulations

Dear Senator Percy:

I am gratified to learn that you will be holding a public hearing on Energy and Governmental Regulations in Chicago on October 22, 1981. My concern in this area relates to my representation of the Citizens For The Preservation of Knox County, which said group has been a very active watch dog organization, regarding the expansion of strip mining in the State of Illinois, the consequential destruction of prime agricultural lands and the implementation of a permanent regulatory program in the State of Illinois. I have been advised by members of the Knox County Group that they have been in close contact with your staff and we very much appreciate the courtesy and considerations extended to them.

The purpose of this letter is to simply relate experiences, observations and insights gained in our dealings with the Illinois Department of Mines and Minerals and its regulatory procedures. The Preamble of the Federal Strip Mining Act notes that one of the reasons the Federal Act was adopted was because it had been found that state regulatory agencies tend to favor local industries and therefore, regulation is often times kept to a minimum. It has been my observation that nowhere is such an attitude of conciliation by a regulatory agency of the coal industry more evident than in the State of Illinois.

Our experience with the Illinois Department of Mines and Minerals has been one of frustration and down right disgust with the manner in which they "regulate" the surface mining industry in the State of Illinois. It has been our experience that the Illinois Department of Mines and Minerals overtly aligns itself with the coal industry in litigation at both the State and Federal Court levels. It has also been our experience that the Illinois Department of Mines and Minerals is doing its utmost to emasculate the implementation of the Federal Strip Mining Act in the State of Illinois through the promulgation of regulations which not only directly contravene the Federal Act, but are designed to keep the regulatory efforts strictly an in house affair so as to frustrate attempts to preserve the agricultural base of the State of Illinois through legitimate legal and other channels. It has been our further experience that the Illinois Department of Mines and Minerals spends a great deal of time, effort and energy in attempting to create a facade of regulation when in fact, it appears to be totally committed to the interests of coal mining industry.

It cannot be denied that one of the basic strengths in the economy of our country lies in its flourishing agricultural base. Further, it cannot be denied that prime agricultural lands are being consumed at a most alarming rate. A popular phrase often heard these days is that "the United States is the Saudi Arabia of coal". I believe most people recognize this to be true. This being the case, it is equally as true that hundreds of years of coal reserves are available throughout this country in locations and areas other than those blessed with prime agricultural lands.

In my estimation, it is sheer stupidity if not suicidal to permit any strip mining of prime agricultural lands until such time as the science and art of reclamation are perfected to an indisputable degree and everyone can be safely assured that prime lands will be restored to 100% of their pre-mining productivity levels. To date, this is simply not the case, in spite of what the coal industry and its ally the Illinois Department of Mines and Minerals may claim.

I would welcome the opportunity, along with other members of the Knox County Group to discuss these matters further with you and/or your staff. I understand that the public hearing to be held on October 22, 1981, is limited by certain time constraints and that not everyone who may want to testify will be permitted to do so. If possible, I would appreciate a copy of this letter being made a part of the record of that public hearing.

Thanking you for your time and consideration in this matter, I am,

Very truly yours,

Wm. F. Morris

William F. Morris

WFM:csc

United States
Department of
Agriculture

Economic
Research
Service

Rural Development
Research Report
Number 29

Coal Development In Rural America

The Resources at Risk

Wallace McMartin
Virgil Whetzel
Paul R. Myers

Summary

Some rural lands and waters are at risk as America turns increasingly to developing its own vast coal reserves to decrease dependence on energy imports. In the eighties, far more coal will be mined, moved, and burned or converted to gas and liquid fuels, based on current expansion plans.

Generalizations about coal development are often unreliable or are valid only in specific geographic areas. For example, coal-related impacts, such as demands on water supplies or farmland disturbances from strip mining, may be only subregional or local.

The living conditions of some rural people may be adversely affected by coal development. However, coal development will generate more electricity nationwide and can stimulate more jobs and provide more tax revenues for some rural communities.

The impacts of coal development will vary in intensity and among geographical areas; they will be partly beneficial and partly adverse. Identifying and evaluating these locational impacts is a complex task for economic analysts. Before they can weigh either the benefits or the adverse impacts, they must know where, when, how, and how much coal is to be mined, moved, and used. This report describes the location and magnitude of coal reserves. It identifies the land, water, and human resources potentially involved in coal development, thus setting the stage for even more detailed analyses in future U.S. Department of Agriculture reports.

Relatively little farmland will likely be disturbed by the increased surface mining of coal, and any loss in agricultural production because of mining would not be serious nationally or regionally. Potential losses in farm income resulting from increased strip mining are estimated at $16 million annually for the six U.S. Coal Production Regions—less than 0.2 percent of the $11 billion farm income from these regions in 1979 (see fig.). The largest loss would be about $10 million annually in the Interior Region, where coal mines occupy land that is highly productive. In the Eastern Region, more land would be disturbed, but the value of agricultural production per acre is much lower and use patterns are less intensive; thus, the value of production lost would be about $4 million annually. In the Northern Great Plains and the Gulf Regions, the loss per region would be about $1 million annually.

However, in some areas current uses of water may be severely disturbed by coal development. Large quantities of water are required for cooling coal-fired electrical generating plants. Water is also used as a feedstock for coal gasification (converting coal to gas) and as a vehicle in slurry pipeline transportation of coal. Available supplies of water vary tremendously from one locality to another. In some coal-rich areas, such as the Tongue and Powder River Basins in Wyoming and Montana, and in the Colorado River Basin, surface water supplies are so scarce that added competition from coal development could become a serious problem. In other areas, such as most of the Eastern and Interior Regions, new coal development would use only a small portion of available surface water supplies.

Water quality is a major issue in coal development plans in any region. The question is not whether available supplies are of the right quality for coal development, but how such development will affect water quality for other uses. Water can be adversely affected in two ways: One is pollution from the mining operations, primarily acid mine drainage, and the other is thermal pollution from coal processing plants. Therefore, energy conversion plans must consider the problems of abating both air and water pollution.

Although some large cities are located on or near the edges of major coal producing areas, most counties in these areas are nonmetropolitan. Coal mining, although a major occupation in some local areas, represents only a small part of the total employment from a regional or national viewpoint. Most areas of new and rapidly expanding coal mining activity have a low population base and a relatively small work force. Thus, the socioeconomic impact of coal development on these areas may be far more severe than in those where mining is already well established.

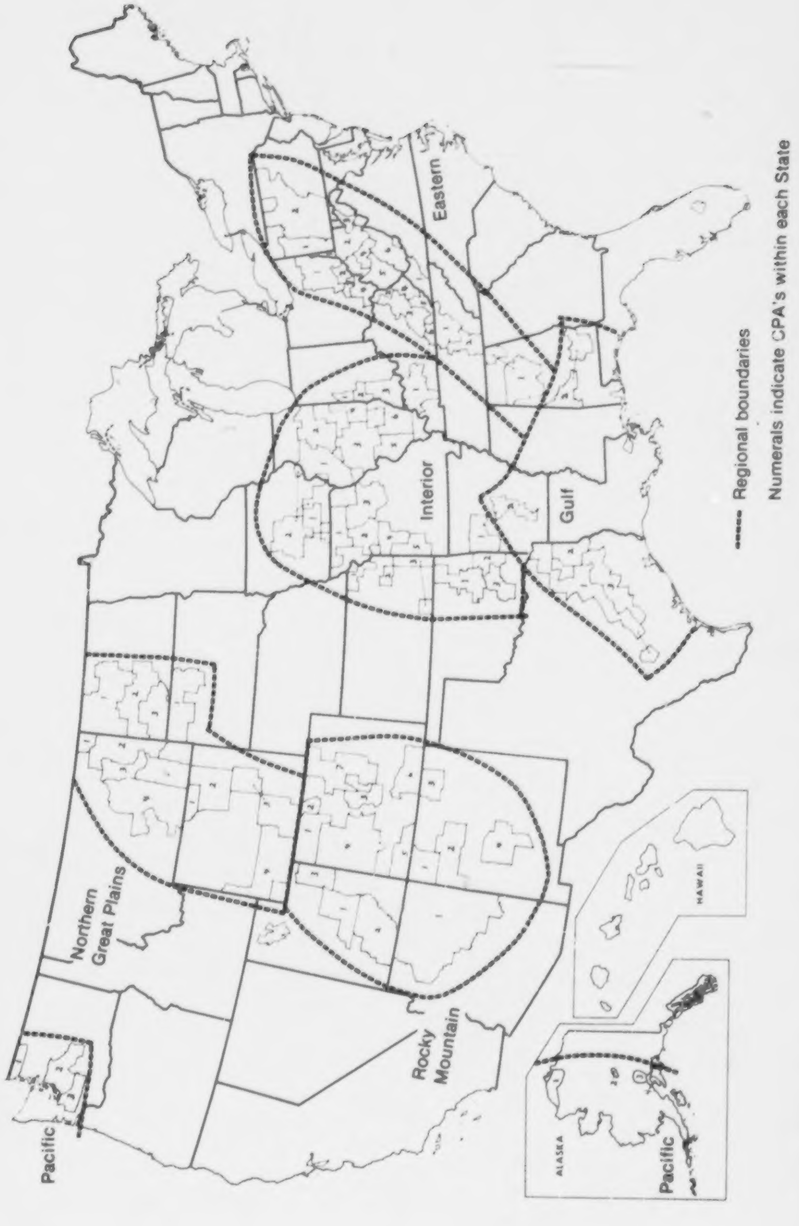
U.S. coal reserves are huge—about 437 billion tons. At the 1979 rate of production (estimated at 770 million tons) these reserves would last more than 500 years (see table). Coal reserves are concentrated mainly in three regions; the Northern Great Plains has 42 percent of the total, and the Interior and Eastern Regions have 24 percent each. There are, however, significant differences in quality. The cleanest coals, as measured by sulfur content, are in the western regions, while the coals with the highest heat content are in the Eastern and Rocky Mountain Regions.

An increasing share of U.S. coal production has come from the West in recent years. Based on announced plans of U.S. coal mining companies (always subject to change), the Northern Great Plains could increase its share further, from 15 percent of U.S. production in 1979 to over 30 percent by 1989; and the Rocky Mountain Region, from 7 percent to over 10 percent. At the same time, the Eastern share could drop from 54 percent to under 40 percent; and the Interior share, from 19 percent to under 15 percent.

In the Northern Great Plains, the coal is mostly subbituminous (soft); more than half is low in sulfur content, and it is found in very thick seams. About 60 percent of these coal reserves are owned by the Federal Government; the rest is

Figure 1

Coal Production Areas (CPA'S)



Characteristics of coal development, by Coal Production Region

Item	Unit	Northern Great Plains	Rocky Mountain	Interior	Eastern	Gulf	Pacific
Reserves	Bil. tons	178	24	105	105	4	14
	Pct. of U.S. total	42	6	24	24	1	3
Sulfur content[1]	Pct.	59 low	75 low	2 low	26 low	7 low	81 low
	do.	41 med	25 med	21 med	56 med	93 med	19 med
				77 high	18 high		
Coal ownership	do.	60 Federal	75 Federal	All private	Nearly all private	All private	[2]
Production, 1979	mty.[3]	118	52	144	423	27	6
	Pct. of U.S. total	15	7	19	54	3	1
Potential new capacity by 1987[4]	mty.	331	112	55	87	58	1
Potential production in 1987[5]	do.	449	164	199	510	85	7
	Pct. of U.S. total	32	12	14	36	6	*
Farm production displaced annually	1,000 dollars	939	185	9.762	4,212	995	35
Counties:							
Metro[6]	No.	0	6	41	35	7	2
Nonmetro	do.	47	35	159	136	44	4

* = Less than 0.5 percent.

[1] low = 0.063 or below (1971-77 "Compliance Coal"); med = more than 0.063 and less than 0.316; high = 0.316 or more. Ratio equals sulfur ÷ 10^7 Btu per pound.

[2] Coal is mostly private in Washington. In Alaska coal is either Federal, State, or tribal; the proportion of each is undetermined.

[3] mty = million tons per year.

[4] Planned increases in capacity of existing mines plus capacity of new mines.

[5] New capacity plus 1979 production. No allowance made for mines which may reduce or discontinue production at some future date.

[6] Metro counties are those included in Standard Metropolitan Statistical Areas (SMSA).

owned by States, Indian tribes, or private owners. Although actual production in the Northern Great Plains in 1979 was only 15 percent of the Nation's total, over 300 million more tons could be produced annually in the eighties. Nearly all the increase will likely be by surface mining. If achieved, this would result in a total production of nearly 450 million tons per year (mty) by about 1987.

The Eastern and Interior Regions each contain roughly 105 billion tons of coal, or 24 percent of the national total. The Eastern Region, however, far exceeds all others in current production with 54 percent. Eastern reserves are mainly bituminous; about one-fourth are low in sulfur, and the seams are thin compared with those for western coal. Nearly all the Eastern Region's coal rights are owned by private individuals or corporations. Future expansion possibilities for coal output are moderate, especially when compared with current production, and most of the new capacity will be in deep mines. Total production could reach 510 mty if all expansion plans were realized.

The Interior Region's coal is all bituminous, and three-fourths of the reserves are high in sulfur content. The average coal seams are thinner than in any other region. Virtually all coal rights are privately owned. The Interior is second among the regions in production but fifth in potential expansion, mostly through underground mining.

The Rocky Mountain Region has 6 percent of the Nation's coal reserves and produces 7 percent of the total U.S. coal output. Most reserves are low in sulfur and the seams are relatively thick. Most reserves in Arizona and New Mexico are owned by Indian tribes. Of the remaining reserves, about 75 percent are federally owned. Potential exists for tripling the annual production by the late eighties, from 52 million to over 160 million tons.

Most coal reserves in the Gulf Region are in Texas, and these consist almost entirely of lignite. More than 90 percent is medium in sulfur content; the rest is low in sulfur. All reserves are privately owned; all production is from surface mines. Planned expansion will be more than three times current production.

Known coal reserves in the Pacific Region are mostly subbituminous, low in sulfur content, and found in relatively thick seams. However, the region consists of two dissimilar areas—relatively small coalfields in Washington and potentially large ones in Alaska, some of which are still unexplored. Not much expansion is expected in Alaska because local demand is likely to be small, and the distance to out-of-State markets is great.

Glossary

AR	As received (from the mine)
ASA	Aggregated subareas
bbl	Barrel
BLM	U.S. Bureau of Land Management
BOM	U.S. Bureau of Mines
Btu	British thermal unit
CAA	Clean Air Act
CPA	Coal Production Area (groups of coal production counties)
CPR	Coal Production Region (groups of CPA's)
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESS	Economics and Statistics Service
FGD	Flue gas desulfurization
KRCRA	Known recoverable coal resource areas
maf	Million acre-feet per year
metro	Metropolitan
MMcfd	Million cubic feet per day
Mty	Million tons per year
MW	Megawatt (1,000 kilowatts or 1 million watts)
NEP	National Energy Plan, 1977
NGP	Northern Great Plains Region
NGPRP	Northern Great Plains Resource Program (U.S. Department of the Interior)
nonmetro	Nonmetropolitan
NSPS	New Source Performance Standards
OPEC	Organization of Petroleum Exporting Countries
OSM	U.S. Office of Surface Mining
RM	Rocky Mountain Region
SIP	State Implementation Plans
SO_2	Sulfur dioxide
SMSA	Standard Metropolitan Statistical Area
TVA	Tennessee Valley Authority
USGS	U.S. Geological Survey

Coal Development in Rural America: The Resources at Risk

Wallace McMartin, Virgil Whetzel, and Paul R. Myers*

Introduction

Coal is an important part of the solution to our Nation's energy problem. But the mining, transportation, and burning of coal can harm the environment. Moreover, rapid development of coal mining operations and huge coal-burning electric power plants also bring problems of major social and economic change, of natural resource management, and of competition for some of these resources between new and traditional activities, such as agricultural production. In this report, we analyze those natural and human resources that will be most affected by the development of our massive coal reserves.

Energy Problems, Resources, and the Environment

Coal development has been influenced to a significant degree by policies and programs to reduce environmental damage. For example, Federal standards established in the seventies regulate sulfur dioxide emissions from fossil fuel combustion to reduce degradation of air quality. One way to meet these emission standards is to burn very low sulfur coal. Because the Nation's reserves vary widely in sulfur content and in other characteristics from region to region, the rate of coal mining and use in any area will depend significantly on relative costs of alternative technologies for sulfur dioxide control.

The cost of burning local, high-sulfur coal and removing the sulfur from power plant emissions must be weighed against the cost of burning lower sulfur coal. Most low-sulfur coal reserves are in the West; therefore, Eastern and Midwestern power plants can obtain this coal only at great transportation expense by bringing it 1,000 miles or more from the mine. In addition, enforcing the new standards for reclaiming surface-mined land will probably change cost-price relationships among coals of different areas and thus lead to a faster pace of coal development in some regions than in others.

Even at modest rates of expansion, the coal industry in any given area has some obvious problems. How can the industry maintain and increase its past rate of development while minimizing damage and maximizing benefits to the local area? Both public policymakers and managers of private enterprises have many options on how to proceed with coal development and at what pace. Some options are still open even though a substantial portion of total potential inputs, such as capital investment in mining, may have already been committed.

Objectives of the Report

In this report, we describe the resource base in rural America that will be affected by future mining, transportation, and use of coal. These resources—land, water, vegetation, people, and farm or ranch enterprises—will be affected, for better or worse, by further development of the Nation's massive coal reserves.

However, we do not analyze systematically the likely impacts of coal development on these resources. Future impacts depend very much on projections of the kinds and extent of coal development that may occur. Therefore, in this "situation report," we describe the resource base itself as a prerequisite for any subsequent impact analysis. Projecting coal development alternatives and impact patterns is reserved for future reports, especially those resulting from runs of the Interregional Coal Analysis Model (*24*).[1]

Integrated Assessment and the ESS Project

What are some of the major options for expanding coal mining and use? What are some of the likely alternative patterns for coal development? Previous reports have addressed these questions and laid important groundwork (*11, 12, 16, 49, 51, 55, 69, 75, 104*). However, a more comprehensive analytical system is needed. Any analysis of these options and their impacts should assess alternative systems of coal development and evaluate interregional tradeoffs attributable to these alternatives. The Economics and Statistics Service (ESS) of the U.S. Department of Agriculture (USDA) has undertaken a comprehensive analysis in its project, "Integrated Assessment: Economic and Social Consequences of Coal and Oil Shale Development," conducted in cooperation with the Environmental Protection Agency (EPA).[2]

This research is scheduled to continue through 1984, with the objective of constructing an interregional analytical system based on a large-scale linear programming model. The model is designed to simulate the economic and environmental impact of changes in national demand for coal on the regional patterns of U.S. coal mining (*24*).

Methodology: Coal Production Areas

Despite the descriptive nature of this report, a key analytical concept is introduced—that of Coal Production Regions

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[1] Italicized numbers in parentheses refer to references listed at the end of this report.

[2] A complete list of the acronyms and abbreviations used in this report appears in the glossary.

(CPR's) and Coal Production Areas (CPA's). This is basically a method of classifying data on a regional and subregional basis to facilitate assessing impacts of alternative development patterns upon relatively small areas.

In addition to small-area data, regional aggregate information is also useful. Defining basic geographic units for this report, the CPR's and CPA's, permits the economic model to aggregate and later to disaggregate data back down to the smallest geographic unit. In other words, the CPA is the basic geographic building block for the analytical system, and the CPR is an intermediate block.

After considerable study of the data available, the research team decided counties, or groups of similar counties, should be used to define the boundary lines of CPA's. At times, they used site-specific information, but site-by-site data were not always available, uniform, or appropriate to the issue at hand. As a geographic unit for organizing and aggregating basic data, the county is the best compromise between specificity and generality.

However, when a topic or issue warrants, we assembled data by areas unrelated to county lines, such as river basins or electric demand regions. We acknowledge that effects of coal development, such as electric transmission lines or commercial development, often extend well beyond coal production counties. However, using the CPA concept does not inhibit analysis of wider geographic effects.

Counties with similar coal characteristics are grouped into CPA's if they contain coal in commercial or potentially commercial quantities. Some CPA's may consist of only one county, but most contain more than one, and in no case does a CPA boundary cross a State boundary. Counties having no known significant amount of coal are not included in CPA's. Characteristics considered were rank of coal, average heat content, average sulfur content, and mining method most likely to be employed—that is, surface or underground (*79*). Generally counties with less than 10 million tons of reserves were omitted. The basis for county selection was two 1975 reports of the U.S. Bureau of Mines (*26, 74*). In a few cases more recent data suggest that certain other counties might have been included, but complete information was not available until the study was well underway.

We define six CPR's: the Northern Great Plains, Rocky Mountain, Interior, Eastern, Gulf, and Pacific Regions. In three cases the regions divide States; Kentucky is divided between the Interior and Eastern, Alabama is divided between the Eastern and Gulf, and Arkansas is divided between the Interior and Gulf Regions (fig. 1, see p. iv). From the CPR's, 86 CPA's were established, consisting of an aggregate of 516 counties with a total land area of 329 million acres (table 1).[3] Each CPA is identified by a symbol consisting of a two-letter abbreviation for the State, then a dash, then a numeral, for example, KY-4, KY-5, PA-1. No CPA includes counties in more than one State. Appendix table 1 shows a complete listing of the counties in each CPA.[4]

Coal

U.S. coal reserves total about 437 billion tons—enough for 500 years or more at the current rate of production. The Northern Great Plains has 42 percent of these reserves, while the Interior and Eastern Regions have 24 percent each. The cleanest coals, as measured by sulfur content, are in the West, but the coals with the highest heat content are found in the East and Rocky Mountains. In recent years, a larger and larger share of coal production has been coming from the West.

Resources and Reserves

Although estimates conflict on the amount of coal which exists in the United States, there is general agreement that coal reserves are abundant. According to the U.S. Geological Survey (USGS), the identified coal resources of the United States are about 1.7 trillion tons. In addition to identified resources, 2.2 trillion tons are classified as hypothetical resources, which brings the total to nearly 4 trillion tons (*3*). However, a more realistic estimate is one which includes coal that can be recovered under present economic and technological conditions—that is, the demonstrated coal reserve base.[5] The U.S. Bureau of Mines (BOM) estimates that the U.S. reserve base totaled about 437 billion tons, in 1974 (*26, 74*). Preliminary estimates for 1979 production are about 770 million tons, and if this rate were maintained indefinitely, the coal reserves would last 568 years.[6]

As many variables affect the ability of a given coal seam to qualify as a reserve, sufficiently precise and detailed data are

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[3] Not counting Alaska, where there are no counties. The four Alaska CPA's occupy parts of six Census districts, each of which is much larger in area than any of the counties in most other States.

[4] Appendix tables begin on p. 55.

[5] The terms coal "resources" and coal "reserves," which must be distinguished, are used here as defined by the U.S. Geological Survey and the U.S. Bureau of Mines (*3, 26*). In general, the term "resources" means the total quantity of coal in the ground within a certain depth and within a specified limit of coalbed thickness. By contrast, the terms "reserves" or "reserve base," which are much more restrictive, denote only some of the "demonstrated resources," and of these, only those legally and economically minable with current technology and equipment. Even though a deposit is classified as a "reserve," it is not necessarily attractive for near term development. A deposit may be reclassified from "resource" to "reserve" if both economic factors and extraction technology improve.

[6] This figure merely indicates the size of the reserves and is not a forecast.

Table 1–Counties and land area included in Coal Production Areas (CPA's)

Region and State	CPA's	Counties	Land area of CPA's[1]
	Number		*1,000 acres*
Northern Great Plains:			
Montana	5	15	25,485
North Dakota	3	21	20,462
South Dakota	1	4	6,632
Wyoming	4	7	24,424
Total	13	47	77,003
Rocky Mountain:			
Arizona	1	3	25,357
Colorado	7	26	34,064
New Mexico	4	5	16,023
Utah	3	7	15,283
Total	15	41	90,728
Interior:			
Arkansas (NW part)	1	7	3,095
Illinois	6	68	24,525
Indiana	3	19	4,902
Iowa	2	26	9,007
Kansas	3	11	4,497
Kentucky (W part)	1	14	3,823
Missouri	5	39	15,332
Oklahoma	3	16	7,833
Total	24	200	73,014
Eastern:			
Alabama (N part)	1	12	6,337
Kentucky (E part)	5	33	7,561
Maryland	1	2	696
Ohio	4	26	8,066
Pennsylvania	2	29	14,831
Tennessee	2	19	5,045
Virginia	1	7	2,072
West Virginia	6	43	12,336
Total	22	171	56,943
Gulf:			
Alabama (S part)	1	9	4,552
Arkansas (SE part)	1	5	2,257
Texas	3	37	17,667
Total	5	51	24,476
Pacific:			
Alaska	4	*	*
Washington	3	6	7,286
Total	7	6	7,286
Total, all regions	86	516	329,450

* = No meaningful figure.
[1] Compiled from (*84*).

not available at the national level. However, despite deficiencies in the BOM reserve estimates, the data are useful insofar as they indicate the magnitude and relative distribution of coal reserves. From the available data one general conclusion is obvious–the United States has an abundance of coal, and no one now living is likely to see a coal shortage in this country.

Of the total U.S. coal reserves, the largest proportion, 40 percent, is located in the Northern Great Plains (table 2). The Interior and Eastern Regions each have about 24 percent of total reserves, and the Rocky Mountain, Pacific, and Gulf Regions have 5, 3, and 1 percent, respectively (*26, 74*).

These comparisons are made without adjustments for differing heat values among coals. For accurate comparisons of coal reserves among regions, or comparisons of different coals in the same region, the units of measure should be common, and for this report we use the British thermal unit (Btu). The average heat value per ton of coal in the United States is approximately 22.6 million Btu's per ton, ranging from 14.6 million Btu's per ton in the Gulf Region to 26.3 million Btu's per ton in the Eastern Region (*26, 68, 74*).

When the tonnages of all U.S. coal are adjusted to a "standard Btu coal" basis, the estimate for the proportion of coal reserves in each region changes.[7] The greatest changes occur in the Northern Great Plains and Eastern Regions. In the former, the estimate decreases from 40 to less than 36 percent, and in the Eastern Region, it increases from 24 to more than 28 percent of total reserves on a standard basis. In the Rocky Mountain and Interior Regions, the increase is less than 1 percent, and in the Gulf and Pacific Regions, the decrease is less than 1 percent.

Strippable and Deep-Minable Reserves.[8] U.S. coal reserves vary in rank among and within regions.[9] The 233 billion tons of bituminous coal reserves form the predominant rank, accounting for 53 percent of total (table 3). The remaining reserves consist of 168 billion tons of subbituminous (38 percent), 28 billion tons of lignite (6 percent), and 7 billion tons of anthracite (2 percent). Unadjusted for heat value differences, about 69 percent of total U.S. reserves were classified by the BOM as accessible only by underground mining and 31 percent by surface mining (*26, 68, 74*). All but a small amount–about 3 percent–of these reserves are located in the 86 CPA's (as previously defined).

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[7] A "standard Btu coal" is defined in this report as coal which yields 22.6 million Btu per ton. Therefore, a quantity of any other coal of a nonstandard Btu value per ton, yielding a certain total heat value for that tonnage, can be adjusted to a standard Btu coal tonnage yielding an equivalent total heat value. The adjusted quantity is called a "standard equivalent."

[8] For convenience, in this report the terms "strip" and "strippable" are used synonymously with the more general term "surface" or "surface minable."

[9] Rank is assigned to a coal according to its percentage of fixed carbon, the main determinant of its heat value. In general, the higher the percentage of fixed carbon, the higher the value. However, the rank is calculated on a mineral-matter-free basis. Minerals and ash content are used to calculate a coal grade (quality) with a rank; in general, the greater the mineral and ash content, the lower the quality.

Two regions, the Northern Great Plains and Pacific, have bituminous, subbituminous, and lignite reserves. Subbituminous coal is the predominant rank in both regions. The Northern Great Plains accounts for 88 percent of all U.S. subbituminous reserves, most of which are located in MT-4, MT-5, and WY-2 (*79*). The Northern Great Plains also has about 86 percent of the total lignite reserves, most of which are located in North Dakota and eastern Montana. The Interior and Eastern Regions contain primarily bituminous reserves and together account for 90 percent of total reserves in this rank. Reserves tend to be concentrated in a few CPA's; for example, IL-3 has 22 billion tons, IL-6 has 17 billion tons, OH-1 has 15 billion tons, and four CPA's (PA-1, KY-1, WV-2, and WV-5) each have more than 12 billion tons. The Rocky Mountain Region has both bituminous and subbituminous coal and accounts for 7 and 5 percent, respectively, of total reserves in these ranks. The Gulf Region has lignite reserves only, which account for 15 percent of total lignite reserves (*26, 68, 74*).

Except for the Gulf Region, which has strippable reserves only, all regions have both deep-minable and strippable reserves. In the Pacific Region, the majority of the coal reserves, 58 percent, are surface minable. In the Northern Great Plains, deep-minable and strippable reserves are nearly equal, with 53 percent deep-minable and 47 percent strippable. In the remaining regions, however, deep-minable reserves prevail and account for 84, 73, and 86 percent of total reserves for the Rocky Mountain, Interior, and Eastern Regions, respectively.

Sulfur Content. Sulfur content is a key factor in determining coal quality, especially regarding Federal air quality standards. If sulfur content is low enough, a coal, when burned, will meet the 1971-77 Clean Air Act sulfur dioxide emission

Table 2–Coal reserves by region, 1974

Region	Quantity		Percentage of U.S. total		Heat value[2]		Standardization factor[4]	Contents per quantity unit			
	A.R.[2]	Standard coal equivalent	A.R.[2]	Standard coal equivalent[3]	Per pound	Per ton		Moisture[2]	Ash[3]	Sulfur	
										A.R.[2]	Standard coal equivalent[5]
	- - - Million tons - - -		*- - - Percent - - -*		*Btu's*	*Million Btu's*	*Units*	*- - - - - Percent - - - - -*			
Northern Great Plains	175,198	153,682	40.1	35.5	9,910	19.8	1.14	17.5	7.7	0.8	0.91
Rocky Mountain	23,592	25,925	5.4	6.0	12,400	24.8	.91	9.8	7.8	.5	.46
Interior	104,683	105,740	24.0	24.4	11,390	22.8	.99	9.9	10.6	3.1	3.07
Eastern	104,966	122,053	24.0	28.2	13,130	26.3	.86	3.9	8.8	1.7	1.16
Gulf	4,242	2,728	1.0	.6	7,310	14.6	1.55	31.5	9.2	1.2	1.86
Pacific	13,598	11,622	3.1	2.7	9,630	19.3	1.17	17.0	10.1	.2	0.23
Other[6]	10,472	11,636	2.4	2.7	12,550	25.1	.90	NA	NA	NA	NA
Total or average	436,751	433,385	100.0	100.0	11,300	22.6	1.00	11.8	8.8	1.6	1.60

NA = Not available.

[1] Percentage of each region's total.

[2] A.R. = Analysis on an as received basis; there has been no beneficiation.

[3] Adjusted to a standard 22.6 million Btu/ton.

[4] The standardization factor indicates the number of tons of nonstandard Btu coal necessary to produce the same Btu value produced from 1 ton of standard Btu coal.

[5] Percentage of sulfur on a standard coal equivalent basis–that is, adjusted to Btu value of the coal.

[6] Coal not in the designated CPA's; includes 7.257 billion tons in the Eastern Region (all anthracite), 2.968 billion tons in the Rocky Mountain Region (bituminous and subbituminous), and 123 million tons in the other regions.

Sources: (*26, 44, 74, 106*).

Table 3–Coal reserves, by region, rank, and mining method

Region	Bituminous			Subbituminous			Lignite			Total		
	Deep	Strip	Total	Deep	Strip	Total	Deep	Strip	Total	Deep	Strip	Total
	Million tons											
Northern Great Plains	5,908	0	5,908	[1]89,416	59,310	148,726	0	23,529	23,529	[1]95,324	82,839	178,163
Rocky Mountain	14,534	1,382	15,916	5,352	2,358	7,710	0	0	0	19,886	3,740	23,626
Interior	81,234	23,449	104,683	0	0	0	0	0	0	81,234	23,449	104,683
Eastern	90,258	14,709	104,967	0	0	0	0	0	0	90,258	14,709	104,967
Gulf	0	0	0	0	0	0	0	4,331	4,331	0	4,331	4,331
Pacific	251	1,201	1,452	5,440	6,402	11,842	0	304	304	5,691	7,907	13,598
United States	192,185	40,741	232,926	100,208	68,070	168,278	0	28,164	28,164	292,393	136,975	429,368

[1] Includes 2,968 million tons not part of designated CPA's.

Source: (*26, 107*).

standards without use of scrubbers to desulfurize flue gases (but not the standards in effect for 1978 and beyond).[10]

Coal containing 0.6 pound or less of sulfur per million Btu will meet the 1971-77 emission standards. In this report, it is defined as "SO_2 compliance coal."[11]

As many existing electric utility steam-generating units are governed by the 1971-77 New Source Performance Standards (NSPS), burning low sulfur compliance coal is a major alternative to installing "stack gas scrubbers" (equipment to clean gasses emitted by plants burning coal). Therefore, it is important to know how much of each region's coal reserves can be classified as SO_2 compliance coal.

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[10] Sulfur in coal burned by electric power plants contributes to equipment corrosion and the formation of boiler deposits. Sulfur oxides as combustion products emitted to the atmosphere can injure many forms of life, including humans, crops, and forests. In recognition of these effects, the Clean Air Act (CAA) limits sulfur dioxide in the atmosphere and sulfur dioxide from certain emissions through its provisions for (1) air quality and standards to be achieved by "State implementation plans" (SIP) and (2) New Source Performance Standards (NSPS) for new electric generating plants and other new facilities constructed since 1971. The NSPS, in effect from 1971 through 1977, required that no more than 1.2 pounds of sulfur dioxide be emitted per million Btu of fuel burned. Sulfur dioxide is formed at that approximate rate during normal combustion of coal containing 0.6 pound of sulfur per million Btu. Therefore, at this rate of sulfur dioxide formation, no more than 0.6 pound of sulfur per million Btu can be present (to comply with NSPS) in a fuel intended for combustion without the use of flue gas desulfurization equipment (stack gas scrubbers). Thus, for a standard Btu coal containing 22.6 million Btu per ton, the *defacto* upper limit is 14 pounds of sulfur per ton or 0.7 percent sulfur, if the coal is to yield sulfur dioxide emissions (without scrubbers) no greater than the legal limit for 1971-77 "new sources." NSPS mandated by the 1977 Clean Air Act amendments prescribe the best available control technology, generally interpreted as stack gas scrubbers. Nevertheless, sulfur content is still an important consideration as scrubbers are not required for 1971-77 new sources and as coal sulfur content affects scrubber operations. In general, the lower the coal sulfur content, the easier the scrubber operation and the better the potential for removing a high percentage of a coal's sulfur content.

[11] The concept of "compliance coal" is well established. The term is used in the coal trade and refers to likely compliance with SO_2 NSPS. The concept is also used by the BOM in a recent report on coal sulfur content (*11*).

Researchers at Argonne National Laboratory have estimated the amount of NSPS coal available, on a county basis, by using the following formula:

$$\text{pounds SO}_2\text{ emitted/ton coal fired} = 38\text{ S}$$

where 38 is a constant and S is the percentage of sulfur in coal (for coal containing 2 percent sulfur, S = 2). If the heating value of coal is H (in 10^3 Btu/lb.), then a generating unit meeting NSPS must have:

$$\begin{aligned}\text{lb. SO}_2\text{ emitted/}10^6\text{ Btu} &= 38\text{S (lb. SO}_2\text{ emitted/ton coal fired)}\\ &\quad \text{X (1/2000) (ton/lb.)}\\ &\quad \text{X 1/H (lb. of coal/}10^3\text{ Btu)}\\ &= 1.2\text{ (lb. SO}_2/10^6\text{ Btu) (NSPS limit)}\\ \text{(S/H)} &= 0.632\text{ for NSPS}\end{aligned}$$

As an example, with 12,000 Btu/lb. (H = 12) the sulfur content must be 0.76 percent (= .0632 X 12) or less to meet NSPS (*71*).

About 164 billion tons, or about 38 percent, of the U.S. total reserves are estimated to be SO_2 compliance coal (table 4). All six regions have some compliance coal; the largest absolute amount, 105 billion tons, is in the Northern Great Plains. Of each region's total reserves, the proportionate amount of compliance coal ranges from a high of 81 percent in the Pacific Region down to about 2 percent in the Interior Region.

The 1971-77 sulfur dioxide emission standards required attainment of an emission level not to exceed 1.2 pounds of SO_2 per million Btu for compliance. Current regulations impose much more definitive scrubbing (sulfur removal) requirements.[12] Under the new regulations, plants firing high sulfur coals (those which in an as-mined state would emit greater than 6.0 pounds of SO_2 per million Btu) must remove 90 percent of the SO_2. For coals which in their as-mined state would emit between 2.0 and 6.0 pounds of SO_2 per million Btu, a sliding scale of SO_2 removal between 70 and 90 percent applies. The maximum emission limit is 0.6 pound SO_2 per million Btu (*31, 120*).

Figure 2 shows the SO_2 removal requirements for coals with various heat values and sulfur contents. Any point on the x-y axis may be defined by the following formulas:

1. $$\text{lbs. of SO}_2\text{ emitted/}10^6\text{ Btu} = 2\left[\frac{\text{2,000 lb./ton S \% S}}{\text{Btu/ton}}\right];$$

2. Flue gas desulfurization (FGD) required to meet standard =

$$\left[\frac{1-\dfrac{\text{required emission standard}}{\text{emission from coal prior to FGD}}}{\text{decimal operational efficiency of FGD system}}\right]$$

For example, given a 3-percent sulfur coal of 12,000 Btu per pound:

(24 X 10^6 Btu/ton)

$$\text{lbs. SO}_2\text{ emitted/}10^6\text{ Btu} = 2\left[\frac{2{,}000 \text{ X } 0.03}{24 \text{ X } 10^6}\right]$$

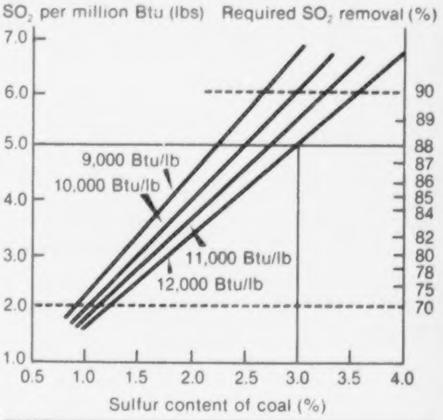
$$= 5\text{ lbs. SO}_2/10^6\text{ Btu}$$

and, assuming a 100-percent efficient FGD system:

$$\%\text{ FGD required} = 1 - \frac{1-\dfrac{0.61}{5.0}}{1} = 1 - 0.12 = 0.88$$

Figure 2

SO_2 Removal Requirements under the 1978 New Source Performance Standards Applicable to Coal-Fired Utility Plants



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[12] The current, new stationary sources performance standards for electric-utility steam-generating units became effective June 11 1979. They apply to units capable of firing more than 73 MW (heat input of fossil fuel) for which construction began after September 18, 1978 (*119*).

In other words, 3-percent sulfur coal with 12,000 Btu per pound in its uncontrolled state would emit 5 pounds of SO_2 per 10^6 Btu and would require 88 percent FGD to meet the emission limit of 0.6 pound of SO_2 per 10^6 Btu (*31, 120*).

As previously mentioned, about 38 percent of total U.S. coal reserves was classified as compliance coal that required no scrubbing to meet 1971-77 NSPS. Under the new SO_2 emission regulations (1978), this same coal requires a 70-percent reduction in potential emissions. About 166 billion tons, or 39 percent, require emission reduction of between 70 and 90 percent (column 7 minus column 4 in table 4). The remaining 99 billion tons require a minimum of 90-percent reduction in potential emissions (column 8 minus column 7 in table 4).

The amount of 1971-77 NSPS compliance coal for each region equals the amount of coal which now requires the minimum of 70-percent reduction in emissions (column 4 in table 4). In three of the regions, Rocky Mountain, Gulf, and Pacific, none of the coal would require the maximum 90-percent emission reduction, and in the Northern Great Plains only an insignificant amount would require maximum reduction. The coals in these regions which would require between 70- and 90-percent emission reduction total about 73 billion tons in the Northern Great Plains, 6 billion tons in the Rocky Mountain, 4 billion tons in the Gulf, and 3 billion tons in the Pacific Regions. In the Interior and Eastern Regions, 22 billion and 59 billion tons, respectively, would require between 70- and 90-percent emission reduction. Both these regions have considerable coal that would require maximum (90 percent) emission reduction. In the Interior, 80 billion tons, or 77 percent of total reserves, would require maximum emission reduction. In the Eastern Region, maximum emission reduction is required for 19 billion tons, or 18 percent of total reserves (column 8 in table 4).

The preceding estimates of sulfur content are linked to the statistical distribution of the demonstrated reserve base. However, the form in which the sulfur occurs is not considered.[13]

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[13] Sulfur occurs in coal in organic and pyritic forms. Organic sulfur, bonded in the coal, cannot be removed by mechanical washing, wheras some pyritic sulfur can be removed. As emission regulations allow the percentage reduction to be computed based on overall SO_2 removed by all types of SO_2 and sulfur removal technology, including washing, the form in which the sulfur occurs in the coal has some bearing upon its pretreatment potential (*11*).

Table 4–Coal reserves, by sulfur content to heating value ratio

Region	Ratio of sulfur content to heating value (percentage S/10^3 Btu/lb.)[1] of–							
	0.021	0.042	0.050	0.063[2]	0.100	0.210	0.246	≥0.316[3]
				Million tons				
Northern Great Plains	0	95,777	98,996	105,192	164,476	177,744	177,927	178,104
Rocky Mountain	3,072	11,450	13,438	17,637	21,182	23,619	23,619	23,619
Interior	0	236	316	2,245	11,232	19,176	24,493	104,683
Eastern	5	9,097	15,105	27,397	39,604	74,590	86,057	104,966
Gulf	0	0	13	280	740	4,242	4,242	4,242
Pacific	0	4,447	9,083	11,071	13,369	13,598	13,598	13,598
United States	3,072	120,987	136,951	163,822	250,603	312,969	329,936	429,212
				Percent[4]				
Northern Great Plains	0	53.8	55.6	59.1	92.4	99.8	99.9	100.0
Rocky Mountain	13.0	48.5	56.9	74.7	89.7	100.0	100.0	100.0
Interior	0	.2	.3	2.1	10.7	18.3	23.4	100.0
Eastern	[5]	8.7	14.4	26.1	37.7	71.1	82.0	100.0
Gulf	0	0	.3	6.6	17.5	100.0	100.0	100.0
Pacific	0	32.7	66.8	81.4	98.3	100.0	100.0	100.0
United States	.7	28.2	31.9	38.2	58.4	72.9	76.9	100.0

[1] Entries indicate reserves with S/H ratios less than or equal to the value stated, and hence are cumulative in any row.

[2] Meets 1971-77 Federal New Source Performance Standards (NSPS) without flue gas desulfurization and meets 1979 NSPS for 70-percent emission reduction.

[3] Requires a 90-percent reduction in emissions for electric generating units constructed after September 18, 1978.

[4] Cumulative percentage.

[5] Less than 0.05 percent.

Source: (*71*).

Although these estimates may not be reliable to the degree desired for long-term energy planning, they indicate the gross availabilities and regional distribution of coals with various sulfur contents.

Reserve Characteristics and Mining Economics. The main factor affecting the economic feasibility of strip mining at any given site is the stripping ratio–that is, the thickness of overburden relative to the thickness of the economically recoverable coal seam or seams. The lower the stripping ratio, the better. Among U.S. regions, average maximum stripping ratios range from 3.5:1 in the Northern Great Plains to 17.7:1 in the Interior Region (table 5).

In many instances, the range in average stripping ratios within regions is greater than between regions. In the Northern Great Plains, average maximum stripping ratios range from 1.9:1 in Montana to 10.0:1 in South Dakota. In the Rocky Mountains, where the range in stripping ratios between States is relatively small, the range is from 6.8:1 in Utah to 8.2:1 in New Mexico. For the Interior Region, the range is from

Table 5–Surface mining coefficients for the United States, by region

Region	Seam thickness	Maximum overburden	Coal yield		Maximum stripping ratios[1]		
	..........*Ft.*..........		*Tons/ acre*[2]	*Std. tons/ acre*[3]	*Ft. overburden/ ft. coal*	*Cu. yds. overburden/ ton coal*	*Cu. yds. overburden/ std. ton coal*
Northern Great Plains:[4]							
Low	5.0	96	7,000	3,910	1.9	2.2	3.0
Average	34.0	118	47,870	33,010	3.5	4.0	5.8
High	64.0	125	90,480	65,380	20.0	23.1	41.3
Rocky Mountain:[4]							
Low	10.0	80	14,160	12,970	6.8	7.1	8.1
Average	12.0	91	16,280	16,120	7.6	9.0	9.1
High	14.0	105	19,930	19,560	8.2	9.5	11.6
Interior:[4]							
Low	2.0	30	2,880	2,590	15.0	16.8	16.7
Average	3.5	62	5,040	5,040	17.7	19.8	19.8
High	4.1	82	5,880	5,880	28.8	32.3	26.5
Eastern:[4]							
Low	2.1	43	3,000	3,570	14.0	15.6	13.5
Average	3.8	58	5,520	6,350	15.1	17.0	14.7
High	4.3	64	6,120	7,290	24.0	26.9	22.6
Gulf:[4]							
Low[5]	3.4	90	4,760	2,380	12.3	14.2	19.6
Average[4]	6.7	93	9,380	6,050	13.9	16.0	24.8
High[5]	7.3	100	10,220	7,410	29.4	33.9	67.8
Pacific:							
Low	–	–	–	–	–	–	–
Average	22.0	220	31,150	22,400	10.0	11.4	15.8
High	–	–	–	–	–	–	–

– = Not available.

[1] Maximum stripping ratios based on criteria used by U.S. Bureau of Mines in establishing reserves.

[2] Based on an 80-percent recovery rate with a yield of 1,440 tons bituminous, 1,416 tons subbituminous, and 1,400 tons lignite per acre foot.

[3] Adjusted to a standard 22.6 million Btu/ton.

[4] Indicates range and average of State averages within each region.

[5] Due to the variability of coal seam and overburden thickness and to the large area under consideration, averages are not available for Alaska. Data for the Pacific Region are for Washington only.

Sources: *(9, 14, 26, 44, 70, 72, 74 106)*.

15.0:1 in Kansas, Missouri, and Oklahoma to 28.8:1 in Arkansas. Stripping ratios in the Eastern Region range from 14.0:1 in eastern Kentucky to 24.0:1 in Alabama, and in the Gulf Region from 12.3:1 in Texas to 29.4:1 in Arkansas. Due to the variability of overburden and seam thickness in Alaska, no range was established for the Pacific Region; however, the average maximum stripping ratio for Washington is 10.0:1.

Another way to express these relationships is to measure them in cubic yards of overburden per ton of coal. By this concept, the average ranges from 4.0 cubic yards of overburden per ton of coal in the Northern Great Plains to 19.8 cubic yards in the Interior. But on another basis--recoverable coal yield per acre of surface area above the coal--the Northern Great Plains is highest, averaging 47,870 tons of recoverable reserves, and the Interior is lowest, averaging 5,040 tons per acre (nonstandard coal). By comparison, coal yield averages 31,150 tons per acre for the Pacific (Washington), 16,280 tons for the Rocky Mountain, 9,380 tons for the Gulf, and 5,520 tons for the Eastern Regions.

When adjusted to a standard ton basis, coal yield per acre decreases to 33,010 tons for the Northern Great Plains, 16,120 tons for the Rocky Mountain, 22,400 tons for the Pacific, and 6,050 tons for the Gulf Regions. For the Eastern Region, recoverable reserves increase to 6,350 tons per acre. For the Interior Region, the yield per acre in standard tons is the same as "as received" tons.

The coal seams of the Northern Great Plains, Rocky Mountain, and Pacific Regions are generally much thicker than those of the Interior, Eastern, and Gulf Regions. Thus, recoverable strippable reserves per acre in the Northern Great Plains, for example, are nine times the reserves per acre in the Interior (seven times on a standard basis). When mining starts, the amount of recoverable reserves per acre is a major influence on both production of coal per acre and mining costs per ton.

The preceding material is based on criteria establishing average coal yields and maximum stripping ratios, but actual mining coefficients may not fall within the parameters set by these criteria. Other factors influencing coal yields include overburden characteristics, slope, and the number, depth, and character of the coal seams. Even so, average stripping ratios and coal yields are useful in comparing relative surface mining coefficients between regions.

Production and Utilization

Coal output attained a record high in 1979. Total production will probably continue to rise gradually, based on announced plans of coal companies to open new mines or expand existing ones. Although most coal is used to generate electricity, other uses, such as gasification or exports, could become increasingly important.

Historical Trends. U.S. coal production hit its lowest point for the past 60 years in 1932, when 309 million tons were produced (app. table 2). Production subsequently moved upward to peak at 631 million tons in 1947, then fluctuated sporadically, and did not reach the 600-million-ton mark again until 1970 (fig. 3). In 1971, output fell to 552 million tons and remained below 600 million tons until 1974, when it reached 603 million tons. By 1977, production had increased to a high of 691 million tons. However, because of an extended strike by the United Mine Workers, production in 1978 fell to 653 million tons (*103, 105*). Preliminary estimates for 1979 are about 770 million tons, a new record (*90*).

Historically, the Eastern and Interior Regions have been the major coal-producing areas of the United States. However, in recent years, as the demand has increased, especially for SO_2 compliance coal, mining activity in other regions has taken on new importance. During the 1970-78 period, coal production decreased from 418 million tons to 370 million tons in the Eastern Region, and from 149 million tons to 126 million tons in the Interior Region. During the same period, coal production increased from 16 million tons to 99 million tons in the Northern Great Plains, from 18 million tons to 45 million tons in the Rocky Mountain, from 0.6 million tons to over 5 million tons in the Pacific, and from near zero to 21 million tons in the Gulf Regions (*103, 105*). Preliminary data for 1979 show substantial increases over 1978 production in every region.

As a proportion of all U.S. production, the Eastern Region decreased from 69 percent to 55 percent, and the Interior from 25 percent to 19 percent in the 8 years from 1970 to 1978 (fig. 4). During the same period, the Northern Great Plains increased from 3 percent to 15 percent, the Rocky Mountain from 3 percent to 7 percent, the Gulf from 0 to 3 percent, and the Pacific from 0.1 percent to nearly 1 percent.

Within regions, a wide difference in production occurred among the CPA's. The leading CPA in production in 1978 was PA-2, with 58 million tons (app. table 3).[14] Three of the five highest producing CPA's were in the Eastern Region. KY-4 in the Eastern Region was second among the CPA's, with 41 million tons. The largest production of coal from deep mines came from KY-4 with 24 million tons and from WV-6 with 21 million tons. In production of strip-mined coal, PA-2 was first with 40 million tons, followed by WY-2 with 29 million and MT-4 with 26 million tons.

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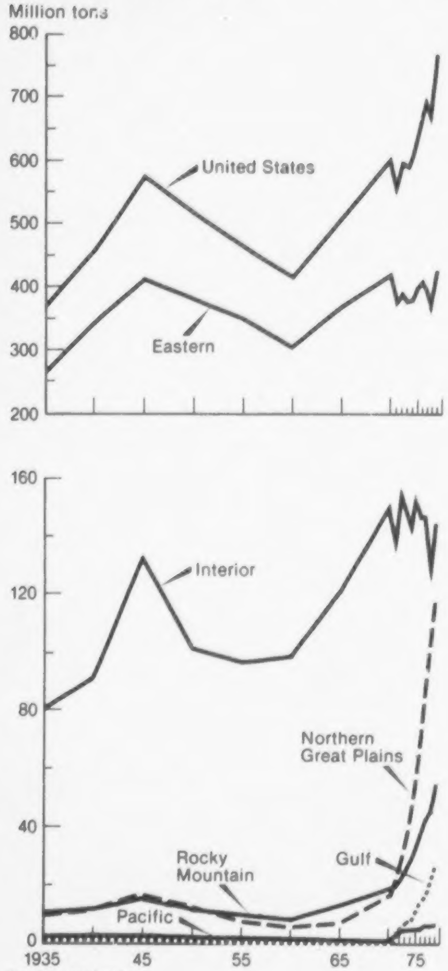
[14] The latest data available by CPA's are for 1978.

Figure 3

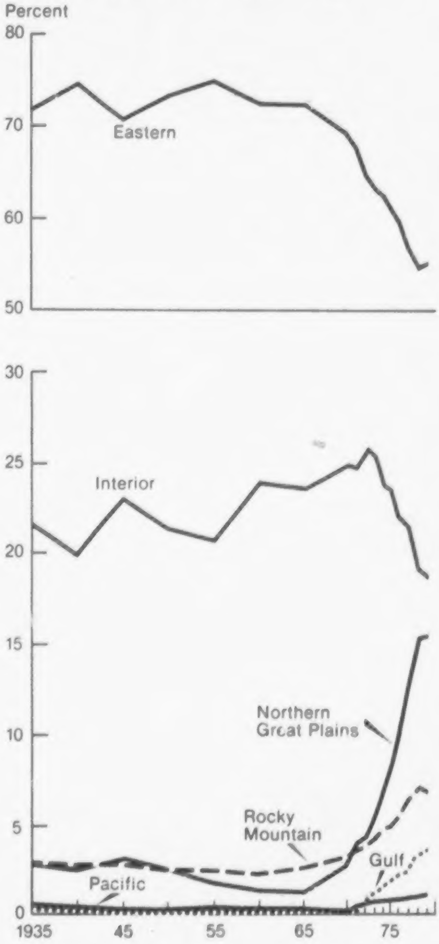
U.S. Coal Production by Region, Selected Years, 1935-79



Sources: *(105, 103)*.

Figure 4

Percentage of Total U.S. Coal Production, by Region, Selected Years, 1935-79



Gulf region data for 1945-71 is less than 0.05 percent.

Source: *(103)*.

As coal production has increased, the proportion extracted by surface mining has also risen, largely because of lower costs per ton, as explained later on. In 1940, surface mining accounted for less than 10 percent of total U.S. production, but by 1979, 61 percent came from surface mines. A similar trend has occurred in each region. For the Northern Great Plains, the proportion of coal extracted by surface mining increased from 25 percent in 1940 to 99 percent in 1979. During the same period, the increase was from less than 1 percent to 71 percent in the Rocky Mountain; from 33 to 63 percent in the Interior; from 3 to 45 percent in the Eastern; from 5 to 100 percent in the Gulf; and from 1 to 100 percent in the Pacific (*103, 105*).

Mine Size and Distribution. In 1978, 6,230 mines were operating in the United States. Of these, 2,502 were underground and 3,530 were surface. Most were small; about 96 percent produced less than 500,000 tons each. The remaining 4 percent accounted for about 50 percent (333 million tons) of total U.S. production (table 6) (*103*). By contrast, mines producing less than 10,000 tons each numbered 1,577 and accounted for only 1.1 percent (7.5 million tons) of total production.

The Eastern Region had the largest number of mines–5,593. However, 69 percent (or 3,833 mines) produced less than 50,000 tons, accounting for 18 percent of production in the region, while 106 mines produced over 500,000 tons each, accounting for 23 percent. In the Northern Great Plains the mines are larger; 27 of them produced more than 500,000 tons each and accounted for 97 percent of the coal mined in that region. The Rocky Mountain Region had 87 mines in 1978, of which 18 produced over 500,000 tons each, 76 percent of total production. Of the Interior Region's 455 mines, 93 produced over 500,000 tons each and accounted for 80 percent of total production. The Gulf Region had six mines, of which five were large (over 500,000 tons each); the Pacific Region had two large mines and one small one. Large mines accounted for more than 98 percent of total production in the two regions.

Projections and Future Plans. In the short run, coal production is limited to what can be produced from existing mines. In the long run, the coal industry can open new mines to increase production as needed. Bringing a new surface mine into production in the East may take from 1.5 to 3 years, including planning, construction time, equipment acquisition, environmental studies, permits, and other necessary requirements. It would take from 4 to 15 years to open a surface mine in the West. The time required to open a new underground mine may range from 2.5 to 5 years in the East and 3 to 13 years in the West.[15]

Projections of future production are difficult to make because so many unforeseeable events could influence future developments. However, because of the long leadtime required, the expansion plans of mining companies can indicate potential changes in production, and a number of projections have been made on this basis. Planned coal mine development, including new mines (either planned or in various stages of development), reopening old mines, and expanding existing mines, would add about 645 million tons of new U.S. coal mining capacity between 1979 and 1987 (table 7). This, however, may not increase net capacity because of closing or decreased production of existing mines (*7, 43, 44, 67, 92*).

The planned development or expansion includes a total of 406 mines–237 underground and 169 surface. About 41 percent (or 166 mines) are planned for the Eastern Region, with the majority (132 mines) being underground mines. Most new or expanding mines in the Rocky Mountain and Interior Regions are also underground. Of 92 mines in the Rocky Mountains, 65 will be underground, and in the Interior, 30 of 65 will be underground. In the Northern Great Plains, 64 of 69 are scheduled as surface mines, and for the Gulf and Pacific Regions, all new or expanding mines, 12 and 2, respectively, will be surface mines.

Although the Eastern Region plans the largest number of mines, total new mining capacity is greatest for the Northern Great Plains, where new or expanded mines could produce about 331 million tons, 51 percent of the total new capacity for the United States. The Rocky Mountain region ranks second in new capacity with 112 million tons, followed by: the Eastern Region, 87 million tons; the Gulf Region, 58 million tons; the Interior Region, 55 million tons; and the Pacific Region, 1 million tons. In the Northern Great Plains and Gulf Regions, the average planned capacity of new or expanded mines would be 4.8 million tons annually, whereas the average capacity in the Eastern and Interior Regions would be 0.5 and 0.8 million tons, respectively. Thus the number of new underground mines exceeds the number of surface mines, but most of the new capacity will be from strip mines, because of their greater average size.

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[15] "The time span for the West relates primarily to environmental and other governmental considerations, which can account for a considerable portion of the time required"–quoted from (*57*). Most western mines involve leasing some Federal coal land, and the requirements for meeting environmental constraints are more time consuming.

Table 6–Number of mines and quantity of production, by region, size, and type of mine, 1978

Region and type of mine	500,000 tons and over		200,000-499,999 tons		100,000-199,999 tons		50,000-99,999 tons		10,000-49,999 tons		Less than 10,000 tons		Total[1]	
	Mines	Quantity	Mines	Quantity	Mines	Quantity	Mines	Quantity	Mines	Quantity	Mines	Quantity	Mines	Quantity
	No.	*1,000 tons*	*No.*	*1,000 tons*	*No.*	*1,000 tons*	*No.*	*1,000 tons*	*No.*	*1,000 tons*	*No.*	*1,000 tons*	*No.*	*1,000 tons*
Northern Great Plains:														
Underground	0	0	2	708	0	0	0	0	0	0	0	0	2	708
Surface	27	96,246	5	1,659	2	285	0	0	1	16	6	42	41	98,248
Total	27	96,246	7	2,367	2	285	0	0	1	16	6	42	43	98,956
Rocky Mountain:														
Underground	6	5,231	19	6,895	8	1,166	9	702	9	216	4	16	55	14,228
Surface	12	28,906	3	705	3	396	2	169	8	221	4	15	32	30,413
Total	18	34,137	22	7,600	11	1,562	11	871	17	438	8	31	87	44,641
Interior:														
Underground	37	37,570	12	4,546	7	896	3	228	4	108	5	18	68	43,366
Surface	43	53,435	44	13,686	46	6,661	73	5,310	128	3,252	93	459	427	82,803
Total	80	91,003	56	18,233	53	7,558	76	5,537	132	3,359	98	476	495	126,168
Eastern:														
Underground	70	54,031	140	44,310	208	29,558	347	24,526	1,069	28,069	741	3,380	2,575	183,874
Surface	36	32,244	149	43,391	258	36,144	552	37,659	1,300	32,929	723	3,545	3,018	185,915
Total	106	86,277	289	87,700	466	65,703	899	62,185	2,369	60,999	1,464	6,926	5,593	369,789
Gulf:														
Underground	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface	5	19,748	1	271	0	0	0	0	0	0	0	0	6	20,020
Total	5	19,748	1	271	0	0	0	0	0	0	0	0	6	20,020
Pacific:														
Underground	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface	2	5,425	0	0	0	0	0	0	1	14	0	0	3	5,439
Total	2	5,425	0	0	0	0	0	0	1	14	0	0	3	5,439
U.S. total:														
Underground	113	96,833	173	56,459	223	31,620	359	25,456	1,082	28,394	750	3,414	2,700	242,177
Surface[2]	125	236,004	202	59,713	309	43,486	628	43,227	1,439	36,453	827	4,067	3,530	422,950
Total[1] [2]	238	332,838	375	116,172	532	75,106	987	68,683	2,521	64,847	1,577	7,481	6,230	665,127

[1] Data may not add to total because of rounding.
[2] Includes Georgia.

Source: (*103*).

Table 7–New coal mine development and expansion of existing mines, by region, 1979-87

Region and State	Number of mines			Production at full capacity			Present capacity[1]	New capacity[2]
	Deep	Strip	Total	Deep	Strip	Total		
					Million tons			
Northern Great Plains:								
Montana	1	11	12	1.00	88.80	89.80	31.80	58.00
North Dakota	1	13	14	4.00	41.44	45.44	10.25	35.19
Wyoming	3	40	43	7.25	285.95	293.20	55.20	238.00
Total	5	64	69	12.25	416.19	428.44	97.25	331.19
Rocky Mountain:								
Arizona	–	1	1	–	8.00	8.00	8.00	0
Colorado	33	10	43	31.64	12.30	43.94	9.60	34.34
New Mexico	1	15	16	1.00	63.40	64.40	18.50	45.90
Utah	31	1	32	43.95	1.00	44.95	13.17	31.78
Total	65	27	92	76.59	84.70	161.29	49.27	112.02
Interior:								
Illinois	22	9	31	42.20	13.20	55.40	21.25	34.15
Indiana	1	8	9	.50	17.60	18.10	9.20	8.90
Kansas	–	3	3	–	2.45	2.45	.42	2.03
Kentucky, West	10	4	14	13.90	3.80	17.70	9.40	8.30
Oklahoma	2	6	8	.75	2.40	3.15	1.20	1.95
Total	35	30	65	57.35	39.45	96.80	41.47	55.33
Eastern:								
Alabama	11	7	18	14.50	5.30	19.80	4.90	14.90
Kentucky, East	31	13	44	21.53	8.95	30.48	17.24	13.24
Maryland	1	–	1	1.80	–	1.80	.70	1.10
Ohio	10	3	13	20.60	3.16	23.76	10.75	13.01
Pennsylvania	19	5	24	19.45	3.51	22.96	11.55	11.41
Virginia	7	–	7	6.30	–	6.30	1.50	4.80
West Virginia	53	6	59	44.15	6.05	50.20	21.60	28.60
Total	132	34	166	128.33	26.97	155.30	68.24	87.06
Gulf:								
Arkansas	–	1	1	–	7.50	7.50	0	7.50
Texas	–	11	11	–	66.70	66.70	16.00	50.70
Total	–	12	12	–	74.20	74.20	16.00	58.20
Pacific:								
Alaska	–	1	1	–	1.30	1.30	.70	.60
Washington	–	1	1	–	4.80	4.80	4.00	.80
Total	–	2	2	–	6.10	6.10	4.70	1.40
U.S. total[3]	237	169	406	274.52	647.61	922.13	276.93	645.20

– = None.

[1] Includes production from mines which were partially developed before 1979 and production from mines now operating that will expand during the 1979-87 period.

[2] New coal production capacity from mines that are currently expanding or developing combined with production from planned mines.

[3] Excludes mines planned for Georgia and Louisiana.

Sources: (*7, 43, 44, 67, 92*).

One should note that these are planned mines, so various factors–economic, environmental, legal, and others–could add to or delete from this number.

Mining Costs: Surface Mines. The cost of mining coal in any region is an important determinant of its competitive position as to alternative fuels and mining costs in other regions. Several approaches have been used to estimate the average cost of mining a ton of coal. The BOM has employed cost budgeting for "model" mines with different configurations typical of a given region.[16] Using this method one can make assumptions about the kinds and sizes of mining equipment suited for assumed layouts, overburden, and mining plans. Costs can be estimated based on the variables. Several U.S. Department of Energy (DOE) and BOM reports conclude that there are economies of size in coal mining (*8, 39, 100*). As a rule, the larger the annual mine output, the lower the total operating costs per ton of coal mined. Furthermore, the stripping ratio is an important element in determining mining costs. In general, the lower the stripping ratio, the lower the unit cost of mined coal.

Model mine cost budgeting is a site cost technique which requires detailed knowledge of mining and is not easily adapted to assessing mining costs for the large number of potential U.S. mine sites. As these costs are affected by many factors, they must be considered in relation to special situations at each individual mine–such as surface topography, drainage conditions, and character of the overburden. Then, model mine operating costs can be used to show the relative production costs between regions. In a recent DOE report, these costs were $3.25 per ton for the Northern Great Plains, $6.76 for the Interior, and $11.66 for the Eastern Regions (table 8) (*8*). Although model mine statistics for the Rocky Mountain, Gulf, and Pacific Regions were not presented in the DOE report, the surface mining parameters for these three regions generally fall between those of the Northern Great Plains and Interior Regions. Thus, it is logical to assume that their costs would fall within this range–that is, between $3.25 and $6.76 per ton.

In a 1978 study conducted by the Office of Surface Mining (OSM), computer simulation macromodels determined annual operating costs for model surface mines (*111*). The models reflected the typical mining method, production level, overburden depth, seam thickness, years of mine life, type of operations, and the equipment required for a mine in each region. Although the resulting costs per ton are considerably higher than those presented in the DOE report, the relative differences between regions are consistent.[17] The least cost was estimated to be $7.67 per ton for the subbituminous area of the Northern Great Plains and the highest cost, $26.28 per ton, for the south and central areas of the Eastern Region (table 9).

In yet another study, case histories describing pertinent geographic, topographic, geologic, and climatic conditions; mining unit operations; and auxiliary functions of representative mines were combined with detailed systems analysis to estimate costs for typical mining operations (*101*). The variations in unit operations formed the base for evaluating each mine's cost. The results were similar to those of the BOM and DOE studies. The low cost was $4.65 per ton for an area mine in the Northern Great Plains and the high cost was $23.00 per ton for a contour truck haulback mine in the Eastern Region (table 10). (See (*41*) for detailed descriptions of kinds of mining.)

Although there are absolute differences in the estimated mining costs in the three studies discussed here, their general conclusions are similar: (1) Costs per ton are lowest in the Northern Great Plains and highest in the Eastern Region, and (2) the method of mining, which is primarily dictated by topography, size of the mine, and stripping ratios, largely determines cost for surface mining.

Mining Costs: Underground Mines. In some regions, primarily Eastern, Interior, and Rocky Mountain, production from underground mines contributes significantly to total coal production, and cost estimates for underground mining are important. Many interrelated variables, such as roof conditions, seam thickness, age and type of equipment, methane concentrations, and other operating conditions, were considered in model mine development. Values assigned to the variables reflect mining conditions characteristic of each region. Production cost estimates of the representative underground mine models indicate that per ton costs are about $25.50 for the Eastern Region, $20.50 for the Interior, and $15.60 for the Rocky Mountain and Northern Great Plains (*111*). These

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[16] The BOM agency responsible for these studies is now a part of the U.S. Department of Energy (DOE).

[17] The cost differences between the OSM and DOE reports are largely attributed to two factors: (1) DOE data are for 1976 and OSM data are for 1978; and (2) the OSM data estimate expected increases in costs due to the 1977 Surface Mining Control and Reclamation Act.

Table 8–Model surface mine parameters for Eastern, Interior, and Northern Great Plains Regions

Item	Unit	Region		
		Eastern	Interior	Northern Great Plains
Annual production	1,000 tons	150	3,360	5,000
Overburden thickness	Feet	60	70	75
Seam thickness	Feet	6	5	57
Stripping ratio	Feet/feet	10:1	14:1	1.14:1
Capital investment	Dollars/ton production[1]	44.45	21.38	10.04
Operating cost	Dollars/ton production[1]	11.66	6.76	3.25

[1] Adjusted to first quarter of 1977.

Source: *(8)*.

Table 9–Computer simulation estimates of operating costs for surface mine models, 1978

Region	Mining method	Median production	Seam thickness	Overburden ratio	Mine life	Production cost
		Tons/year	*Inches*	*Feet/feet*	*Years*	*Dollars/ton*
Northern Great Plains:						
Subbituminous area	Area stripping with truck shovel	5,000,000	554	3:1	20	7.67
Lignite area	Area stripping with dragline	2,800,000	119	6:1	20	8.71
Rocky Mountain	Area stripping with dragline	2,800,000	119	6:1	20	8.71
Interior:						
East	Area stripping with dragline	1,400,000	45	19:1	20	17.32
West	Area stripping with dragline	2,300,000	56	15:1	20	14.62
Eastern:						
South and central	Contour stripping with truck shovel	73,000	40	17:1	5	26.28
	Mountaintop removal with truck shovel	300,000	40	17:1	5	26.28
Northern	Area stripping with dragline	160,000	45	15:1	10	23.16
Gulf	Area stripping with dragline	2,800,000	119	6:1	20	8.71
Pacific	Area stripping with dragline	2,800,000	119	6:1	20	8.71

Source: *(111)*.

estimates show that per ton underground mining costs are generally much greater than those for surface mines.[18]

It must be stressed that costs estimated from model mines should not be compared directly with actual costs of individual mining operations. Even if production values, mining methods, and stripping ratios are identical to those of a representative model mine, various parameters–such as local topography, geology, hydrology, climate, ecology, and managerial ability–will vary from mine-to-mine and result in costs different from those estimated in model mine analysis. Nevertheless, such analysis does provide a means for comparing relative costs of mining among regions.

Distribution of Coal. Of the 641 million tons of coal distributed in 1978, 601 million tons (94 percent) remained within the United States and 40 million tons (6 percent) were exported (table 11).

The out-of-region distribution pattern differs considerably by region; the relative amount of these shipments indicates a region's current surplus or deficit coal-producing capacity. In 1978, the Northern Great Plains shipped 70 percent of its production out of region, whereas none of the Gulf or Pacific Regions' coal was shipped out of region. During the same period, out-of-region shipments accounted for 41, 34, and 27 percent of the Eastern, Rocky Mountain, and Interior Regions' total coal distribution, respectively. Over half (55 percent) the total coal shipped came from the Eastern Region, followed by the Interior (19 percent) and the Northern Great Plains.

Table 10–Estimated surface mining costs

Region and State	Mining method	Annual production	Average overburden thickness	Average seam thickness	Stripping ratio	Operating costs per ton[1]
		1,000 tons	*--------Feet--------*		*Ft. overburden/ ft. coal*	*Dollars*
Northern Great Plains:						
Wyoming	Open pit	3,000	100	27.0	3.7	4.88
Montana	Area	5,000	65	52.0	1.3	4.91
North Dakota	Area	2,000	60	20.0	3.0	4.65
Rocky Mountain:						
Colorado	Area	1,800	70	7.0	10.0	7.42
Interior:						
Illinois	Area	3,000	70	8.0	8.8	6.97
Indiana	Area	1,440	80	4.5	17.8	14.83
Eastern:						
Kentucky	Haulback and mountain top removal	1,750	100	6.7	14.9	16.55
Tennessee	Truck haulback	350	60	14.2	4.2	23.00
West Virginia	Modified block cut	85	60	2.3	26.1	20.07
Pennsylvania	Modified block cut	25	50	2.5	20.1	17.54
	Modified area	120	45	7.8	5.8	14.45
	Scraper haulback	240	50	5.5	9.1	12.58
	Modified area	500	110	3.5	31.4	11.88
Ohio	Modified area	140	40	2.8	14.3	22.11
	Box cut contour	600	80	3.9	20.5	18.34

[1] Cost adjusted to January 1979 using annual average of producers price index (*43*).

Sources: (*43, 100*).

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[18] Production costs for underground coal mines are generally higher than those for surface mines. In the OSM analysis, however, the design characteristics of the models result in production costs that are slightly higher for the surface model in the central and southern areas of the Eastern Region than the costs for the underground model. This inconsistency results from the difference in the models' design lives and production levels. If the output level and design life for the surface model are adjusted upward to those of the underground model, production costs for the underground model are higher than for the surface model.

Transportation. In 1978, of the nearly 600 million tons of coal transported within the United States, 324 million tons (or 54 percent) were moved by railroad; 96 million tons (or 16 percent) were moved by river; and 94 million tons (or nearly 16 percent) were moved by truck.[19] Tramways, conveyer belts, private railroads, and slurry pipelines moved an additional 66 million tons (or 11 percent) where the consumption point was located near the minemouth. About 20 million tons (or 3 percent) were moved by other modes, primarily on Great Lakes and tidewater routes (*102*).

The mode of shipment varies considerably among regions. In the Northern Great Plains, 68 percent of the coal is moved by rail. Rail shipments were also predominant in the Rocky Mountain, Eastern, and Interior Regions; 58, 55, and 49 percent respectively, moved by this mode (fig. 5). The Interior and Eastern Regions were the largest users of river shipment, moving 28 and 18 percent, respectively, of their coal by barge. Significant amounts of coal were moved by truck in all regions (except the Pacific). The largest relative amount moved by truck was 21 percent, in the Gulf Region. In the Gulf and Pacific Regions, most of the coal was moved by tramways, conveyer belts, or private railroads.

Coal Usage. The continued growth in the nationwide demand for electricity has been the main force behind the recent surge in coal development. During the 1970-78 period, coal used to generate electric power in the United States increased 39 percent, from 339 million tons to 471 million tons. During the same period, coal used for making coke decreased 41 percent, from 103 million tons to 65 million tons. Retail sales decreased 87 percent, industrial use 20 percent, and exports 33 percent (*102*).

The end use of coal varies by region because of variations in coal quality, demand within a given region relative to demand in other areas, transportation costs, and other factors. Even so, the predominant use of coal in the United States was for the generation of electricity. Over 90 percent of the coal produced in the Northern Great Plains, Gulf, and Pacific Regions was used for this purpose in 1978 (fig. 6). Relatively less coal from the Eastern Region, about 69 percent of total production, is used for electricity generation; most of its remaining coal is used for making coke (19 percent) and for other industrial uses (11 percent). For the Rocky Mountain and Interior Regions, respectively, 81 and 85 percent of production is used for electricity generation, 8 and 12 percent for making coke, and 10 and 12 percent by other industries. Small amounts of coal are still sold on the retail market in all regions except the Gulf.

Projections and future plans are made on the premise that the electric utility component will continue to increase. Of the projected 645 million tons of new coal production capacity scheduled for 1979-87, about 570 million tons, or 88 percent, are classified as steam coal. Of the remaining 75 million tons, 50 million tons are scheduled for the metallurgical market (coke) and 24 million tons for possible conversion into synthetic gas (*7, 44, 67*).

In all regions except the Eastern, the largest proportion of coal to be produced from new capacity is targeted for the electric utility sector. Of the 331 million tons from the Northern Great Plains, 316 million tons (95 percent) are scheduled for the electric utility market, with the remaining 15 million tons to be used for gasification. For the Rocky Mountain Region, 104 million tons are to be used by electric utilities, 6.5 million tons for gasification, and about 2 million tons as metallurgical coal. The Eastern Region will supply most of the metallurgical coal, 45 million tons, as well as 39

Table 11--Distribution of coal, by region, 1978

Region	Total distribution[1]		Out-of-region shipments	
	1,000 tons	*Percent*	*1,000 tons*	*Percent*
Northern Great Plains	98,866	15.4	69,388	70.2
Rocky Mountain	44,161	6.9	14,806	33.5
Interior	121,600	19.0	32,516	26.7
Eastern	349,870	54.6	141,761	40.5
Gulf	21,006	3.3	0	0
Pacific	5,443	.9	0	0
United States	640,946	100.0	[2]40,386	[2]6.3

[1] For conceptual reasons, total distribution amounts differ from production.
[2] Exports.

Source: (*102*).

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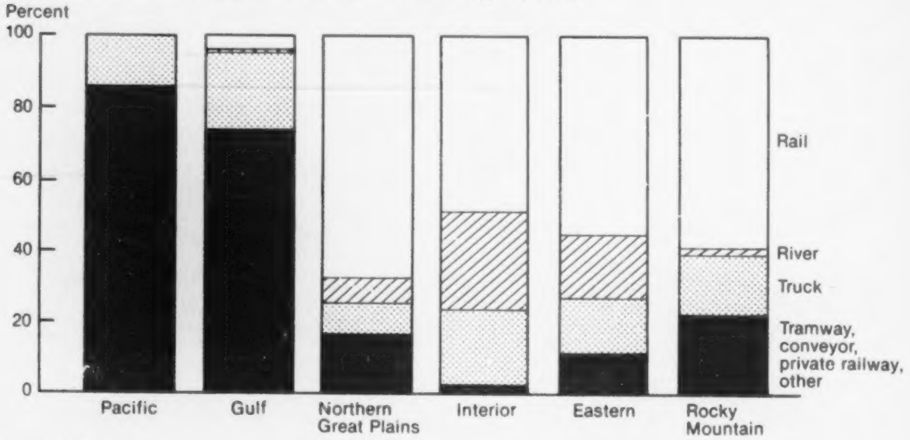
[19] These data do not include about 40 million tons of coal that were exported.

Figure 5

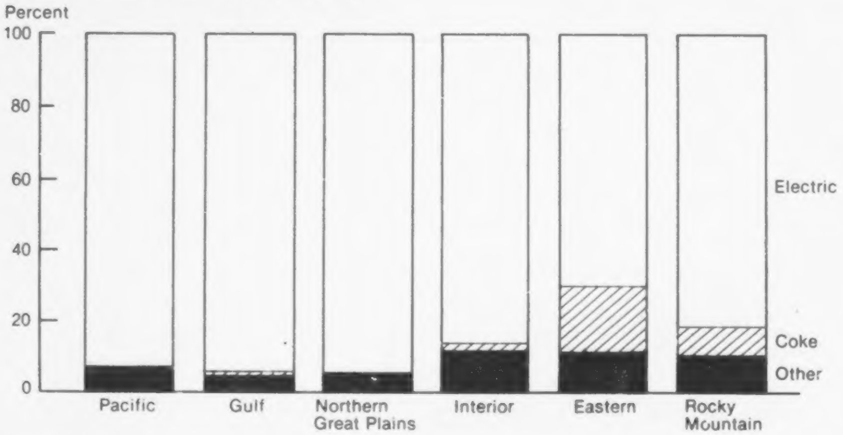
Coal Shipments by Method of Movement and Region, 1978



Source: (*102*).

Figure 6

End-Use of U.S. Coal by Region, 1978



Source: (*102*).

million tons of steam coal and 2.5 million tons for gasification. The Interior Region will contribute 52 million tons of steam coal and about 3 million tons for gasification. Both the Gulf and Pacific Regions will produce steam coal only, supplying an additional 58 million tons, and 1.4 million tons, respectively, by 1987 (*7, 44, 67*).

These projections of demand for coal are based on current conditions, which might be changed by factors unrelated to the mining process. For example, Federal sulfur dioxide emission standards and other air quality standards may be revised again, which might affect the quantity of coal demanded from any given region. Other actions in the near future could affect the overall demand for coal, such as further price increases of oil by the Organization of Petroleum Exporting Countires (OPEC). The pricing of oil is extremely important as coal and oil are substitutable in several uses, including the generation of electricity, especially medium- to long-term. Different patterns of coal transportation via rail or slurry pipeline might develop in response to various constraints, thereby altering demand patterns. The interplay of such factors is to be analyzed by an econometric model, currently used by ESS research people to analyze the impacts of changes in public policy relating to coal development (*24*).

Reclamation of Mined Land

Erosion, sedimentation, impaired drainage, degraded water quality, loss of productivity, and loss of aesthetics have damaged many areas where surface mining has occurred. While the adverse effects of surface mining in the East have been researched and are well-documented, less is known about the potential damage from mining in the West. It is known that western coal seams are sometimes major aquifers and that aquifer disruption caused by surface mining could become a serious problem. Furthermore, many soils in the West are alkaline, and as the overburden is disrupted, the salts become susceptible to leaching, which in turn can contaminate the water. As mining in the West increases, additional environmental problems may be discovered.

The Soil Conservation Service estimates that on July 1, 1977, about 1.7 million acres of land surface mined for coal in the United States needed to be reclaimed (table 12) (*82*). About 1.1 million acres were mined prior to passage of surface mining laws and, therefore, reclamation was not required by law. The remaining 570,000 acres were mined under Federal, State, or local laws that required reclamation. Nearly two-thirds of the land needing to be reclaimed (1.1 million acres, or 64 percent) is in the Eastern Region. Most of the rest, 29 percent, is in the Interior Region. About 735,000 acres in the Eastern Region and about 333,000 acres in the Interior Region are not required by any law to be reclaimed. The only other region with significant acreages needing to be reclaimed is the Northern Great Plains, with 87,000 acres, of which 73,500 acres were mined under specific laws that require reclamation. In addition to the land which has been disturbed and needs reclamation, about 10,500 miles of streams, mostly in the Eastern and Interior Regions, have been affected adversely by mine drainage (*37, 82*).[20]

Table 12—Surface-mined coal land needing reclamation, by region, July 1977

Region	Land needing reclamation[1]		
	Not required by law	Required by law	Total
	Acres		
Northern Great Plains	13,552	73,519	87,071
Rocky Mountain	8,146	5,037	13,183
Interior	332,592	156,624	489,216
Eastern	734,948	328,715	1,063,663
Gulf	3,320	3,736	7,056
Pacific	2,748	1,190	3,938
Other[2]	1,832	1,267	3,099
U.S. total	1,097,138	570,088	1,667,226

[1] Includes land adjacent to the actual mining area whose natural state has been disturbed by the mining operation.

[2] Includes California, Georgia, and Michigan, States with extremely small coal reserves, and those not classified in Coal Production Regions.

Source: (*82*).

The increased demand for coal in recent years has created pressures to use even more land for coal production. This has increased land use conflicts based on controversies between economic, environmental, social, and aesthetic interest groups and, in many cases, has heightened opposition to surface mining. In response to this opposition, reclamation has recently become an integral part of the mining process.

Goals of Reclamation

Reclamation is intended to minimize adverse effects during and after mining and to return surface-mined land to productive use. The reclamation process accomplishes these goals by (1) alteration of the contour and topography of the land subsequent to mining, (2) preparation of the land for rapid re-establishment of vegetation, and (3) abatement of water pollution resulting from mining (*19, 83*).

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[20] These streams are polluted by increased amounts of acid, sediments, sulfates, iron, and hardness. Over 70 percent of the acid mine drainage originates in underground mines.

Alteration of the contour and topography of mined land is accomplished by backfilling and grading. Backfilling refers to placing spoil (waste material removed by mining) back into the mined area; grading then determines the final condition of the spoil surface. These two operations help determine the potential use of the mined land and, when properly conducted, can aid in reducing adverse environmental impacts of mining–such as landslides, land subsidence, erosion, water pollution, and aesthetic degradation (*19, 113*).

Since many untreated spoils are toxic to vegetation, because of acidity or alkalinity, the mined land must be prepared for rapid reestablishment of vegetation. This preparation includes any action which improves the spoil surface and increases the chances of establishment and survival of plants. This includes seeding and/or planting the land, improving texture, chemistry, and moisture retention ability of the spoil. One way to improve soil characteristics is by replacing topsoil after mining. In most instances, topsoil is beneficial to vegetation because its texture, chemistry, and moisture-retention characteristics are superior to those of unconsolidated spoil. Disking, subsoiling, ripping, or other tillage practices also improve spoil texture and moisture-retention characteristics as well as provide a roughened surface where seeds and seedlings can be held in place until plants are established (*19, 32, 83*).

Abatement of water pollution resulting from mining can be accomplished either by eliminating the conditions which lead to water pollution or by treating runoff from the mined area. The first approach prevents the water from entering the mining environment, thus keeping it away from pollution sources such as sulfur-bearing coal and overburden. Other methods which can be used to prevent water pollution are the installation of diversion ditches around the top and sides of the mine, the sealing of fractures, and the placement of highly polluting materials where contact with water is avoided. For mine drainage which cannot be prevented, several methods of treatment are available. One popular method of treatment involves collecting runoff in a sediment pond located below the mine. Once in the pond, the sediment is allowed to settle out and the mine effluent is neutralized by chemical treatment. Other methods of treatment include ion exchange, reverse osmosis, and electrochemical oxidation (*19, 29, 113*).

Legislation

Although some mining companies have practiced reclamation for years, in the past it was not a general practice largely because of the expense involved. Although early surface mining laws were passed in West Virginia (1939), Indiana (1941), Illinois (1943), Pennsylvania (1945), and Ohio (1947), they addressed only the basics of reclamation, such as revegetation and erosion control (*36*).

During the fifties and sixties, existing laws were revised and additional States adopted laws which generally added requirements for soil conservation and water quality control. By 1970, all the mining States in the Eastern Region and half those in the Interior had adopted reclamation laws. However, none of the States in the Rocky Mountain, Gulf, Pacific, or Northern Great Plains Regions, except North Dakota, had imposed reclamation laws. As surface mining activity increased in these regions, legislatures responded to social pressures for environmental protection, and by 1975 all major coal-producing States had adopted reclamation laws (*17, 36*).[21]

Surface mining and reclamation laws vary among States because of topographic and climatic conditions. Laws also vary among States in the extent and effectiveness of their coverage as well as in the regulatory agency's willingness to enforce the law. Thus, mining companies operating in States with stringent and highly enforced regulations are at a competitive disadvantage when compared with those operating in States with minimum regulations. Realizing the unwillingness of some States to accept responsibility for adopting and enforcing laws which would adequately protect the environment, the Congress passed the Surface Mining and Reclamation Act of 1977 (*77*). The purpose of the act was to "(a) establish a nationwide program to protect society and the environment from the adverse effects of surface coal mining operations." Twelve other purposes, (b) through (m) as listed in the act, elaborated upon the main purpose. Specifically mentioned were provisions intended to protect the rights of surface landowners, to prevent undue losses in agricultural productivity, to protect the environment, to require prompt reclamation of mined land, to promote the reclamation of previously mined but unreclaimed land, to provide for public participation in preparing regulations and standards, and to provide for data collection, research, and analysis for improving mining and reclamation techniques. Two of the listed purposes deserve special emphasis. One was to provide assistance to States in developing programs to achieve the purposes of the act; the other was to assure coal supplies adequate to serve national energy requirements while maintaining a balance between coal mining, agricultural productivity, and environmental protection.

The 1977 act transfers the regulatory jurisdiction over coal mining and reclamation to the Federal Government, with the Office of Surface Mining (OSM) as administering agency. It is the intent of the act to allow individual States to reassume the primary regulatory authority role by incorporating the Federal minimum standards into their laws and by developing permit and enforcement programs approved by OSM. Under an OSM-approved program, an individual State has the authority to develop more stringent regulations, issue permits, make inspections, issue citations, and perform other pertinent functions. Even though a State may have an approved program, OSM has the authority to duplicate enforcement (*77*).

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[21] For Alaska and Arizona, mining is on Indian, Federal and/or State lands; case-by-case State regulatory decisions and/or Federal coal leasing regulations apply to mining and reclamation in these States.

Unlike previous reclamation laws which permitted varying degrees of reclamation on a State-by-State basis, the 1977 act establishes minimum environmental performance standards for mining and reclamation on all lands, and it provides for numerous other objectives such as the reclamation of abandoned mines, assistance in mitigating energy development impacts, and funding for State mining and mineral resources institutes.

Although there has been, and will continue to be, considerable debate on the advantages and disadvantages of Federal regulations, the fact remains that they now exist. Their immediate impact will vary from State to State, depending largely on the degree of reclamation and enforcement formerly in effect. In those States where reclamation laws were stringent and enforcement requirements strict, the impacts will be less than in States where requirements were minimal. However, it is generally agreed that the 1977 act will have far ranging effects on the U.S. coal industry.

Reclamation Costs

Reclamation costs may be separated into three broad categories, including premine planning, backfilling and grading, and revegetation. The costs associated with premine planning generally consist of (1) an engineering study, including mapping of the mine site, a study of drainage patterns, and development of data to support the permit application; (2) the design and construction of pollution control systems; and (3) the costs of bonding, permits, and application fees (*21, 63*).

Backfilling and grading costs, which are difficult to apportion between mining and reclamation, include (1) removing vegetative cover from the area to be mined, (2) removing and stockpiling topsoil, (3) backfilling the disturbed areas with spoil, (4) grading the spoil, and (5) replacing the topsoil.

Depending on revegetation requirements and intended postmining land use, revegetation includes combinations of the following operations: (1) soil preparation, such as disking, harrowing, and gouging; (2) addition of amendments, such as lime and fertilizer; (3) seeding and/or planting; (4) mulching; and (5) irrigation.

The topography of the mine site dictates the mining and reclamation method to be used and influences cost. Site conditions present varying degrees of difficulty in completing the required reclamation. The two basic methods of mining are area and contour, with various modifications. The area method, which is normally utilized in level or gently rolling topography, tends to hold down reclamation costs by limiting the handling of overburden material. The placing of overburden in the previous cut eliminates excessive handling and also allows the same machinery to be used in both the mining and reclamation processes. The contour and similar methods require removal of the overburden and its return or placement in the fill. This added handling, along with decreased machinery effectiveness, adds to reclamation costs. Furthermore, if an unmined fill is used for disposition of spoil, this area too must be reclaimed.

Case studies of representative surface mines show that per acre reclamation costs vary considerably both among and within regions (*21, 63, 101*.)[22] However, reclamation costs are generally lowest in the Gulf Region and highest in the Eastern Region (table 13). Backfilling and grading is the most costly operation, but it varies from less than 60 percent of total cost in the Gulf Region to over 90 percent in the Eastern Region and in the eastern portions of the Interior Region. Premining planning ranged from less than 5 percent of total cost in the Interior and Eastern Regions to 40 percent in the Gulf Region. Revegetation accounted for less than 10 percent of total cost in all regions, except the arid sections of the Rocky Mountain Region where irrigation increased revegetation costs to 14 percent of the total per acre reclamation costs.

Reclamation costs expressed as dollars per acre are useful for various purposes, such as determining the amount of bond an operator must post to assure acceptable reclamation. Costs expressed in dollars per ton provide for relative comparison of reclamation costs with other mining costs. Per ton mining costs for the aforementioned representative surface mines range from a low of 8 cents per ton, for an area mine producing 3 million tons per year in the Northern Great Plains, to over $6 per ton, for a contour mine producing 208,000 tons per year in the Eastern Region.[23]

Data on combinations of surface mining methods, slope degrees, and production capacity indicate that per ton reclamation costs are less (1) for area mines, (2) on sites with less

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[22] Reclamation costs for the Pacific Region are not included. However, mining methods are similar to those used in the Northern Great Plains.

[23] These costs do not include incremental amounts attributed to the permanent regulatory program of the Surface Mining Control and Reclamation Act of 1977. Although these incremental costs vary considerably, estimates for model mines indicate that the dollar per ton increases could be as follows: Northern Great Plains, 0.03; Rocky Mountain, 0.10; Interior, 0.30-0.38; Eastern, 0.43-1.87; Gulf, 0.30; and Pacific, 0.10 (*111*).

Table 13—Estimated averages of mined land reclamation costs, by region, 1978

Region and State	Site[2] number	Mining method	Annual production	Average slope	Mined area	Average costs[1]							
						Premining		Backfilling and grading		Revegetation		Total	
						Per ton	Per acre	Per ton	Per acre	Per ton	Per acre	Per ton	Per acre
			1,000 tons	*Degrees*	*Acres/ year*	*Dollars*							
Northern Great Plains:													
Montana, North Dakota and Wyoming	1	Area	3,200	<10	100	0.01	538	0.16	5,054	<0.01	195	0.17	5,787
	2	Area	1,300	na	140	.07	688	.31	2,773	.01	135	.39	3,597
	3	Area	3,000	na	80	.01	344	.07	2,349	< .01	172	.08	2,865
Rocky Mountain:													
Arizona and New Mexico	1&2	Area	na	na	na	.06	917	.10	1,925	.01	401	.17	3,243
Colorado	3	Area	na	na	na	.08	825	.17	1,639	< .01	40	.25	2,504
Interior:													
Kansas and Missouri	1-6	Area	na	na	na	.24	1,106	.44	1,719	.01	52	.69	2,877
Indiana, Illinois, and Ohio[3]	1	Area	720	10	220	.10	358	2.78	9,077	.14	478	3.02	9,913
	2	Contour	650	15	460	.15	213	4.89	6,911	.35	501	5.39	7,625
	3	Area	1,300	5	150	.06	430	2.50	18,340	.03	143	2.59	18,913
	4	Contour	6,000	17	2,400	.15	390	4.91	12,249	.08	188	5.14	12,827
	5	Area	900	5	192	.07	365	1.47	6,912	.04	154	1.58	7,431
Eastern:													
Alabama, Kentucky,[4] and Tennessee	1	Contour	130	25	65	.46	931	4.31	8,629	.23	458	5.00	10,018
	2	Contour	30	25	10	.25	240	4.80	4,806	.43	426	5.48	5,472
	3	Contour	208	24	120	.37	656	5.51	9,548	.23	413	6.11	10,617
	5	Contour	543	25	180	.09	420	4.08	18,483	.12	555	4.29	19,458
	7	Area	250	10	90	.06	169	1.21	3,389	.04	96	1.31	3,654
	8	Area	250	10	40	.05	332	1.63	10,163	.06	432	1.74	10,927
	9	Area	1,280	10	360	.17	573	2.48	8,828	.01	61	2.66	9,462
Maryland, Pennsylvania, Virginia, and West Virginia	1	Area	800	9	180	.05	234	1.43	6,345	.10	447	1.58	7,026
	2	Contour	180	25	90	.13	265	4.84	9,695	.22	433	5.19	10,393
	3	Contour	15	20	6	.10	258	3.19	7,956	.19	478	3.48	8,692
	4	Contour	45	15	12	.06	223	4.13	15,487	.04	129	4.23	15,839
	5	Area	108	10	29	.06	243	2.78	10,315	.08	284	2.92	10,842
	6	Area	100	100	8	.05	217	2.53	10,110	.09	317	2.67	10,644
Gulf:													
Texas	1	Area	na	na	na	.06	504	.08	722	.01	40	.14	1,266

na = Not available.

[1] Costs adjusted to 1978 by using ICF's past and projected reclamation cost index (*33*).

[2] Site numbers designated by U.S. Bureau of Mines (*21, 63*). Combined analysis for sites 1-6 in Kansas and Missouri and sites 1 and 2 in Arizona and New Mexico. Sites 4 and 6 in the Eastern Region were excluded due to special operating conditions.

[3] Due to the similarity of mining and reclamation methods, Ohio is included with Indiana and Illinois for reclamation cost analysis.

[4] Includes both eastern and western Kentucky.

Sources: (*21, 33, 63*).

than 20° slope, and (3) on sites with 500,000 tons or more annual production (*21, 63*).

Given these general relationships, one should recognize that surface mining is a site-specific undertaking. Each mine is different and represents a different reclamation situation. Interaction of various factors—such as topography, thickness and composition of the overburden, thickness and character of the coal seam, hydrological characteristics, climate, mining method, size and type of equipment used, reclamation laws, postmining land use, and accounting procedures—limit the accuracy of predicting reclamation costs. Even so, examining reclamation costs for representative mines allows a general comparison of mined land reclamation costs within and between U.S. regions.

The Land Resource

Relatively little farmland will likely be disturbed by the increased surface mining of coal. Any loss of agricultural production because of mining would not be serious regionally or nationally. Losses of farm income as a result of land disturbance by strip mining will probably total about $16 million annually for all the coal regions, or less than 0.2 percent of the $11 billion total farm income for these regions.

Landownership

Patterns of landownership vary widely among the coal production regions, due largely to the difference in settlement patterns. In the Eastern, Interior, and Gulf Regions, most of the land is privately owned, whereas in the three western regions, a substantial part is publicly held, that is, by Federal, State, or tribal governments. Settlement history had a decisive role in establishing ownership patterns. Some of the land titles in the Eastern Region can be traced back to grants to colonists from the British Crown before the Revolutionary War. Virtually all the land in the Eastern Region and most of the eastern part of the Interior Region had passed into private ownership by the 1850's. In most of the Northern Great Plains, Rocky Mountain, and Pacific Regions, little settlement occurred prior to the passage of the Homestead Act of 1862, and at that time most of the land was still in the public domain. As one of the purposes of the Homestead Act was to settle the land for agriculture, the first homesteaders chose the best land, or the land most accessible to transportation routes, leaving the poorest or most remote land until last. The land least suited to farming or ranching was not settled at all, but remained in the public domain. It is now administered by the Bureau of Land Management (BLM).

The homesteading period lasted until about 1920, by which time all the land suitable for crop production without irrigation had been taken. During this period, however, large areas in the West were withdrawn from public entry for special purposes, such as the creation of national forests, national parks, and national wildlife refuges. Where public domain land was not available for special purposes, as in most of the area east of the Mississippi, land was purchased from private owners. During the homesteading period, grants of land were made to States and railroads, and Indian reservations were formed.

In the Rocky Mountain Region, more than 40 percent of the land is in Federal ownership, of which 18 million acres are administered by BLM, while the Forest Service has nearly 15 million acres (table 14). Indian ownership accounts for 21.5 percent of the land and the States own 6.4 percent, leaving only 31.7 percent in private ownership. Indian land is concentrated mainly in three CPA's, namely AZ-1, NM-1, and NM-2 (app. table 4).

In the Northern Great Plains, BLM owns most of the public land although the Forest Service and Indian tribes own important acreages. Railroad companies—especially the Burlington Northern—have a substantial part of the privately owned land in the Northern Great Plains and in part of the Rocky Mountain Region. Grants made to railroads by the Federal Government were in alternate sections for specified distances on either side of the main line right of way.[24] The resulting checkerboard pattern of ownership persists in most areas where land grants were made (*96*).

In the Interior, Eastern, and Gulf Regions, the Forest Service is the principal owner of Federal land. Most of the land in these three Regions had passed into private ownership long before the National Forests were established, so the land needed for the forests was purchased from private owners. The Interior Region contains a small amount of Indian land, mostly in the CPA's in Oklahoma.

Data for other owners of public lands are not available by counties for the Interior, Eastern, and Gulf Regions, so a tabulation by CPA's was not possible; however, data by State show that federally owned land is uncommon. In Arkansas and Virginia, the two States with the most Federal land, 9.8 and 9.1 percent, respectively, are federally owned (table 15). Most of this is in National Forest, although the Corps of Engineers has substantial holdings, much of which is water surface for flood control or hydro power. The Tennessee Valley Authority (TVA) is an important Federal owner in the Eastern Region. TVA also owns large acreages of water surface for dams and reservoirs. Some States, like Iowa, Ohio, Kansas, and Illinois, have less than 2 percent of their total area in Federal ownership.

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[24] A section, a unit of land measurement, typically a square measuring 1 mile on each side, contains 640 acres.

The Pacific Region contains two areas vastly different in landownership. In the CPA's located in Washington, the pattern is somewhat analogous to that of the Rocky Mountain Region—more than a third of the land is Federal (primarily Forest Service). The ownership pattern in Alaska is difficult to describe, partly because of unsettled claims on the part of the State and the native tribes.[25] Before Alaska was admitted to the Union in 1959, 99.8 percent of the land was Federal, mostly administered by BLM, although there were two national forests and some land in military reservations. With statehood came confusion in landownership (*1*). The Statehood Act and other laws provided for the State to receive 104 million acres, but by 1971, only about 26 million acres had been selected for State ownership (*95*). Native claims were established at 40 million acres by the Congress in 1971. The exact location and acreage of all State and native claims has not yet been settled, but it is estimated that eventually the State will own about 28 percent of the land, native tribes almost 12 percent, and private owners about 0.3 percent (*95*). The vast majority of Alaska's land is likely to remain in public ownership for many years to come.

Ownership of Coal Rights

The previous discussion of landownership refers to surface ownership only; the owner of the surface does not necessarily own any of the minerals underneath. Coal is no exception; in some areas there may be several seams, each one owned by still another party. Geographic patterns of coal ownership vary considerably because of differences in how the coal rights became separated from the surface rights. The right to mine coal or other minerals can be bought and sold separately, and such transactions have been common throughout U.S. history. When the country was first settled, colonists and settlers usually obtained unrestricted title to the surface of the land and everything underneath. But there were exceptions even then. For example, in some grants from the British Crown, "precious metals" were reserved, presumably gold and silver (*27*). Later, the United States transferred land to settlers, to the States, to railroads, and to certain development corporations, all under the provisions of a series of congressional acts, including the well-known Homestead Act. In most cases the new owner obtained title to both the surface and the minerals. As the purpose of settlement was usually for farming or grazing, surface rights were initially regarded as more useful, and therefore more valuable, than mineral rights. Later, when minerals were discovered or believed present, a market developed for

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[25] Alaska was omitted from table 14 and appendix table 4 because comparable data were impossible to obtain.

Table 14—Land in public ownership in Coal Production Regions, by agency[1]

Region	Bureau of Land Management	Forest Service	Recreation and wildlife	Military	Other Federal agencies	Total Federal[2]	Indian land	State	Private	Total land area[2]
	1,000 acres									
Northern Great Plains	11,078	4,457	309	979	187	17,011	4,262	3,747	51,982	77,003
Rocky Mountain	18,369	14,863	1,879	396	1,118	36,625	19,546	5,767	28,790	90,728
Interior	na	1,270	na	na	na	na	179	na	na	73,014
Eastern	na	1,974	na	na	na	na	0	na	na	56,943
Gulf	0	404	0	405	9	819	0	na	na	24,476
Pacific[3]	17	1,792	627	203	14	2,653	13	482	4,137	7,286
All regions[2]	29,464	24,760	na	na	na	na	24,000	na	na	329,450
	Percentage of total area									
Northern Great Plains	14.4	5.8	0.4	1.3	0.2	22.1	5.5	4.9	67.5	100.0
Rocky Mountain	20.2	16.4	2.1	.4	1.2	40.4	21.5	6.4	31.7	100.0
Interior	na	1.7	na	na	na	na	.2	na	na	100.0
Eastern	na	3.5	na	na	na	na	0	na	na	100.0
Gulf	0	1.7	0	1.7	[4]	3.3	0	na	na	100.0
Pacific[3]	.2	24.6	8.6	2.8	.2	36.4	.2	6.6	56.8	100.0
All regions	8.9	7.5	na	na	na	na	7.3	na	na	100.0

na = Not available.

[1] For sources and explanation of details, see appendix table 5.

[2] Data may not add to total because of rounding.

[3] Excludes Alaska.

[4] Less than 0.5 percent.

Table 15–Federal landownership in Interior and Eastern Regions, 1975

Region	Bureau of Land Management	Forest Service	Fish and Wildlife	National Park Service	Department of Defense		TVA[1]	Other Federal	Total Federal	Indian land[2]	All other	Land area	Ratio of Federal land to total land
					Corps of Engineers[1]	Military							
	1,000 acres												Percent
Interior:													
Arkansas	2	2,463	132	28	553	95	0	1	3,274	0	29,971	33,245	9.8
Illinois	*	254	56	*	191	51	0	11	563	0	35,116	35,679	1.6
Indiana	0	179	8	4	116	176	0	4	486	0	22,616	23,102	2.1
Iowa	0	0	26	2	176	20	0	1	224	4	35,574	35,802	.6
Kansas	1	108	22	1	320	167	0	[3]94	712	27	51,605	52,344	1.4
Missouri	*	1,452	43	82	495	73	0	4	2,150	*	42,007	44,157	4.9
Oklahoma	8	291	80	1	865	182	0	[3]87	1,513	1,264	41,243	44,020	3.4
Total Interior	10	4,746	367	118	2,716	764	0	202	8,922	1,295	258,132	268,349	3.3
Eastern:													
Alabama	3	637	9	6	74	179	214	1	1,123	0	31,907	33,030	3.4
Kentucky	0	648	2	62	311	162	159	5	1,349	0	24,504	25,853	5.2
Maryland	0	0	22	31	8	126	0	15	202	0	6,567	6,769	3.0
Ohio	*	164	8	*	103	37	0	18	330	0	26,052	26,382	1.3
Pennsylvania	0	506	8	13	104	30	0	7	669	0	28,344	29,013	2.3
Tennessee	0	618	21	256	191	149	515	[4]39	1,788	0	25,248	27,036	6.6
Virginia	0	1,618	72	269	114	282	2	29	2,385	0	23,738	26,123	9.1
West Virginia	0	958	*	1	105	2	0	4	1,069	0	14,407	15,476	6.9
Total Eastern	3	5,150	142	638	1,010	967	889	118	8,917	0	180,767	189,682	4.7

*Less than 500 acres.

[1] A substantial part of this is water surface.

[2] From U.S. Bureau of Indian Affairs, as of Sept. 30, 1977 (*93*).

[3] Nearly all of this is owned by the U.S. Bureau of Reclamation (93,500 acres in Kansas and 70,800 acres in Oklahoma).

[4] About 37,000 acres of this was owned by the Atomic Energy Commission.

Source: U.S. Bureau of Land Management, except as noted, as of June 30, 1975 (*98*).

mineral rights separate from surface rights. In the Appalachian area, which includes most of the CPA's of the Eastern Region, the land was mountainous and forested, and thus not well suited to agriculture, although it was known to have ample coal resources. Coal land–known or potential–became concentrated in the hands of relatively few individuals or firms, many of them with railroad, mining, or lumbering interests. Later coal mining became a major industry and land was valued for its coal, rather than for its agricultural potential. Coal mining companies and other interested individuals and firms bought and sold coal rights, with the idea of obtaining enough coal reserves to permit the long-term operation of large mines. Consequently, there are counties in Appalachia where a few firms or individuals own all or most of the coal, although the surface of the land may be separately owned (*45*).

In the Eastern, Gulf, and most of the Interior Regions, the land surface is owned primarily by private individuals or corporations, and very little is publicly owned. In some CPA's, there are some National Forests and other special-purpose Federal land, but most of this land had once been in private ownership and was purchased by the United States. In many such purchases the Government obtained only surface rights, the mineral rights having been retained by the previous owner. In the States of the Eastern Region, the Federal Government owns the coal rights on only about 145,000 acres, and in the Interior Region, on about 40,000 acres (table 16). Most of the Federal coal rights are in AL-1, although significant acreages are located in OH-4 and KY-5. In the Interior Region, most of the acreage with Federal coal rights is in Kentucky.

Most of the land in the western CPA's was homesteaded, and until the turn of the century, mineral rights were transferred with the land. During the 1900-10 period, Federal policy on coal rights changed, first by executive order and in 1910 by act of Congress.[26] Coal rights to much of the land homesteaded in the Northern Great Plains and Rocky-Mountain Regions were consequently reserved to the United States.

Land granted to railroads and to the States included mineral rights. The railroad companies generally sold their land to settlers as soon as any demand arose but retained mineral rights whenever they had reason to believe that any worthwhile deposits might be found. Much of the land in eastern North Dakota was sold by the Northern Pacific[27] with no reservation as to mineral rights, whereas farther west and in Montana, the company reserved coal and iron rights in part of the land and all minerals in another part. Some of the original grant land was never sold and the railroad still owns both the surface and the coal.

Ownership of Coal Reserves

Statistics showing ownership of coal rights do not tell the whole story because vast areas have no coal and the question of who owns the coal rights is moot. Comprehensive data on the ownership of coal reserves are not available, partly because one must obtain data showing ownership of both the land and the mineral rights as well as the location and extent of coal deposits for each tract. The practice of leasing coal rights to mining companies further complicates obtaining statistics to show who owns the reserves and the amount

Table 16–Federally owned coal areas under non-Federal surface, Interior and Eastern Coal Production Areas (CPA's)

Interior Region		Eastern Region	
CPA	Acres	CPA	Acres
AR-1	1,228	AL-0[1]	3,111
IL-0[1]	186	AL-1	88,669
IL-1	692	KY-2	–
IL-2	42	KY-3	285
IL-3	2,184	KY-4	–
IL-4	80	KY-5	11,822
IL-5	103	KY-6	173
IL-6	60	MD-1	[2] 3,662
IN-1	–	OH-1	4,842
IN-2	–	OH-2	–
IN-3	118	OH-3	–
IA-0[1]	655	OH-4	[3] 18,800
IA-1	40	PA-1	–
IA-2	625	PA-2	6,797
KS-1, 2, 3	–	TN-1, 2	–
KY-0[1]	14,774	VA-1	–
KY-1	12,362	WV-1	–
MO-0[1]	1,003	WV-2	–
MO-1	918	WV-3	–
MO-2	829	WV-4	[2] 7,591
MO-3	1,908	WV-5	–
MO-4	590	WV-6	–
MO-5	1,531		
OK-1, 2	–		
Total	39,928	Total	145,752

– = 0.

[1] Indicates land in counties which are not included within the boundaries of any CPA.

[2] Surface is State owned.

[3] Includes 200 acres of State-owned surface.

Source: (*118*).

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[26] For details, see (*42*).

[27] The former Northern Pacific Railroad, which is now a part of the Burlington Northern Railroad.

each party owns. In the West, however, the BLM has devised a way of developing meaningful data to show the amount of coal owned by the Federal Government.

In six States, the U.S. Geological Survey (USGS) has delineated Known Recoverable Coal Resource Areas (KRCRA's), which are to encompass all places where minable coal reserves are located. The total area of the KRCRA's delineated up to 1978 is 17.3 million acres, and when mapping is complete, it is expected that about 25 million acres will be included (*96*, pp. 2-5). From maps and other data sources, the BLM tabulated each quarter-section tract by classes of public ownership–that is, Federal, by agency; State; and Indian. Surface rights and coal rights were tabulated separately (*97*).

In the KRCRA's of the six western States, the Federal Government owns 65.9 percent of the coal acres, but only 5 million acres of the surface (table 17). There are 5.9 million acres of Federal coal under privately owned surface. In Montana and North Dakota, much of the privately owned coal land belongs to the Burlington Northern Railroad, which is believed to be the largest corporate owner of coal resources in the country (*42*). Data are not available to show the extent to which the private coal land is owned separately from the surface, but for most such land the surface owner probably does not own the coal. In this study, no KRCRA's were established within the boundaries of Indian reservations, although some have large coal reserves (see footnote 2, table 17). Thus, the Indian coal acreage is grossly understated in table 17.

Among the CPA's, the largest acreage of Federal coal is in WY-2, with nearly 2 million acres, mostly under privately owned surface. In WY-4, there are about 1.4 million acres of Federal coal, mostly under federally owned surface. NM-1 and MT-5 also have more than 1 million acres of Federal coal land. In the three North Dakota CPA's and in CO-7, the United States owns one-third or less of the coal area of the KRCRA's. In WY-1, WY-2, MT-5, CO-4, and all the New Mexico and Utah CPA's, the Federal Government owns more than three-fourths of the coal.

Data similar to those shown in table 17 are not available for any of the other CPA's. In the Eastern, Interior, and Gulf Regions, there is very little Federal coal, as suggested by the data in table 16. The BLM has estimated that 3 percent of the coal reserves in Alabama are federally owned, but in the other States in those three regions, there is not enough Federal coal to mention (*96*, p. 2-1). Nearly all coal is privately owned; much of it is held in large blocks by mining companies or other owners closely associated with the mining industry. This is particularly true in West Virginia and Kentucky. For example, in WV-1 a single owner holds title to 41 percent of the entire acreage in the CPA (*45*). Despite the concentration in ownership in some areas, a recent study shows that "by conventional standards, Appalachian coal production is highly competitive," and that there is little likelihood of anticompetitive behavior in the industry (*61*).

The Pacific Region is a special case, consisting as it does of CPA's in Washington and Alaska with widely different ownership patterns. Virtually all the coal in Alaska is owned by public agencies, but ownership patterns are still in flux so the extent of State or tribal coal cannot be determined. In the Washington CPA's, there are large amounts of Federal land, and one coal lease is in effect (*94*). However, there has been no coal production from Federal land in Washington, and no KRCRA's were established; therefore, no data are available to show the extent of Federal coal.

Coal Leasing

Ownership of the mineral estate–coal in this case–usually carries with it the right to explore the resource and mine it. These rights are often conveyed to another party, typically a mining company, by means of a lease. Leasing of coal rights by private owners is common, and it has been the subject of some abuses and much public comment and criticism.[28] The extent of coal leasing from private owners, and the extent to which surface and mineral rights are held separately on private land, is a subject on which little statistical evidence is available. This is because public records are mostly kept at the county level, the form and the degree of detail required vary from State to State, and there is no general requirement for consolidating them. A full description of the problem associated with coal leasing of private lands has been treated elsewhere (*35, 42*).

Leasing of Federal coal, on the other hand, has been the subject of much public debate, legislative action, and litigation, so there are compelling reasons for making data available to the public to show the nature and extent of the practice. The Bureau of Land Management (BLM) has primary responsibility for leasing Federal mineral land and for keeping the relevant records. In 1970, a BLM study of leasing found that the leasing of coal land had increased sharply since 1945 but that production from Federal leases had decreased substantially (*96*). Many people viewed the results of this study as proof of unwarranted speculation in Federal coal leases. In 1971, the BLM established a moratorium on leasing, and as a result of this and subsequent actions, no Federal leasing has occurred since, except for a few special cases. In 1978, the BLM released a Draft Environmental Statement describing a new Federal Coal Management Program, and in April 1979, the final statement was released (*96*). This document not only describes the new program but also gives

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[28] See, for example, (*45*) and (*58*).

Table 17–Land and coal ownership patterns in Known Recoverable Coal Resource Areas (KRCRA's)

Region and Coal Production Area	Federal coal: surface ownership is–					Non-Federal coal: surface ownership is–					Total area of KRCRA[3]	Ratio: Federal coal to area of KRCRA
	Federal[1]	Private	State	Indian[2]	Total[3]	Federal[1]	Private	State	Indian[2]	Total[3]		
	1,000 acres											Percent
Northern Great Plains Region:												
MT-1	–	–	–	–	–	–	–	–	–	–	–	–
MT-2	25.6	240.9	7.3	–	273.8	5.5	331.1	39.0	–	375.7	649.5	42.2
MT-3	5.7	179.8	3.4	–	188.8	–	222.4	23.9	–	246.3	435.1	43.4
MT-4	155.9	545.2	11.1	–	712.2	.1	244.2	61.1	1.1	306.6	1,018.7	69.9
MT-5	481.6	509.9	10.1	–	1,001.6	7.2	219.8	50.4	–	277.5	1,279.1	78.3
ND-1	.5	48.3	.4	–	49.3	.4	119.4	4.3	–	124.1	173.3	28.4
ND-2	29.5	373.6	2.6	–	405.7	15.1	883.7	30.8	–	929.7	1,335.4	30.4
ND-3	53.6	303.9	.6	–	358.0	10.7	686.4	14.5	–	711.5	1,069.5	33.5
SD-1[4]	–	–	–	–	–	–	–	–	–	–	–	–
WY-0	.4	.3	–	–	.7	–	.7	.1	–	.8	1.5	–
WY-1	55.5	632.2	10.6	–	698.3	1.2	110.5	164.6	–	276.4	974.6	71.6
WY-2	349.3	1,625.4	11.5	–	1,986.2	20.4	130.4	156.3	–	307.1	2,293.3	86.6
WY-3	221.1	217.9	1.4	–	440.3	14.8	178.7	32.1	–	225.6	665.9	66.1
WY-4	1,031.7	347.6	3.8	–	1,383.1	.8	769.8	69.2	–	839.8	2,222.9	62.2
Total NGP[3]	2,410.3	5,025.0	62.7	–	7,497.9	76.2	3,897.2	646.4	1.1	4,620.9	12,118.9	61.9
Rocky Mountain Region:												
AZ-1[5]	–	–	–	–	–	–	–	–	–	–	–	–
CO-1	104.1	301.5	.6	–	406.3	4.4	104.3	45.6	–	154.3	560.6	72.5
CO-2	19.2	5.0	2.6	–	26.9	.2	15.1	4.6	–	20.0	46.9	57.4
CO-3	–	–	–	–	–	–	–	–	–	–	–	–
CO-4	282.9	158.3	–	–	441.2	2.7	49.7	3.6	–	56.0	497.2	88.7
CO-5	83.6	58.6	2.9	–	145.0	3.3	76.8	22.2	1.1	103.4	248.5	58.4
CO-6	–	–	–	–	–	–	–	–	–	–	–	–
CO-7	.6	94.8	1.2	–	96.6	–	349.0	28.6	–	377.5	474.2	20.4
NM-1	848.0	130.8	13.3	273.1	1,265.2	24.6	88.0	103.4	82.4	298.3	1,563.5	80.9
NM-2	422.2	62.8	10.3	59.6	554.9	9.7	10.3	34.4	49.3	103.7	658.6	84.3
NM-3	–	–	–	–	–	–	–	–	–	–	–	–
NM-4	11.2	11.0	.6	1.6	24.5	–	.1	.6	–	.7	25.2	97.2

Continued –

See notes at end of table.

Table 17–Land and coal ownership patterns in Known Recoverable Coal Resource Areas (KRCRA's)–Continued

Region and Coal Production Area	Federal coal: surface ownership is–					Non-Federal coal: surface ownership is–					Total area of KRCRA[3]	Ratio: Federal coal to area of KRCRA
	Federal[1]	Private	State	Indian[2]	Total[3]	Federal[1]	Private	State	Indian[2]	Total[3]		
	1,000 acres											Percent
UT-1	247.2	76.2	4.3	–	327.7	1.1	86.3	11.9	–	99.3	427.0	76.7
UT-2	588.1	29.2	.4	–	617.7	4.3	12.7	54.5	–	71.4	689.1	89.6
UT-3	–	–	–	–	–	–	–	–	–	–	–	–
Rocky Mountain total[3]	2,607.2	928.1	36.4	334.2	3,905.9	50.2	792.3	309.4	132.8	1,284.7	5,190.6	75.2
Total, two Western Regions[3]	5,017.5	5,953.1	99.0	334.2	11,403.9	126.4	4,689.5	955.8	133.9	5,905.6	17,309.5	65.9
Percentage	29.0	34.4	.6	1.9	65.9	.7	27.1	5.5	.8	34.1	100.0	N.A.

– = None.
N.A. = not applicable.

[1] Includes Public Domain (administered by the Bureau of Land Management), National Forests, National Grasslands, land withdrawn for special purposes, and all other Federal lands.

[2] Mostly Indian Trust land located outside the established boundaries of Indian reservations. Land within Indian reservations is not included in any of the KRCRA's. Thus, extensive acreages of coal reserves owned by Indians are not included in this table, especially in AZ-1, NM-1, and MT-4.

[3] Data may not add to total because of rounding.

[4] No KRCRA's were established in South Dakota because no coal development is expected.

[5] No KRCRA's were established in Arizona, although there are large reserves and two large mines on the Navajo reservation in AZ-1.

Source: (*97*); see also (*96*).

a history of the various legislative actions, executive orders, and court decisions affecting coal leasing up to 1978.

As part of the data used in developing the Federal Coal Management Program, the BLM presented statistics on leases of Federal coal in the KRCRA's. In the six western coal states, there were about 11.4 million acres of Federal coal. Of this, about 585,000 acres, or 5 percent, were under lease in 1978 (table 18). The largest acreage under lease was in Utah and Wyoming. In addition, nearly 335,000 acres of land were under preference-right lease applications. Where granted, these applications permit exploration and carry the right to lease the coal if commercial deposits are discovered. There are more acres under preference-right lease applications in Wyoming than in any other State. Most of the remaining preference-right application acres are in New Mexico and Utah. There are none in North Dakota. The coal land not yet leased ranges from 68 percent of all Federal coal land in Utah to 98 percent in Montana and North Dakota.

Although the United States is the dominant owner of reserves in the six western States, more than half the production comes from non-Federal coal land. In 1977, production from Federal leases was 51.6 million tons, or 44 percent (table 19). The largest production from Federal leases was in Wyoming–28.3 million tons or 62 percent of the State total. The smallest amount of coal from Federal leases was in North Dakota. There appears to be a trend toward more production from Federal leases. In 1957 the "Federal share" was 28 percent; in 1962 it climbed to 35 percent; then it dropped off to a low of 20 percent in 1972. Since then, the Federal share has increased, reaching 44 percent in 1977.

Land Use

Land use patterns in the CPA's are so varied that attempting to describe a "typical" land use is impractical. In the aggregate, most of the land area of the CPR's is farmland–194 million acres out of 329 million acres in 1974 (table 20).[29] Most of the farmland is pasture, range, woodland, and other (120 million acres), while cropland amounts to 74 million acres. Such gross figures, however, tend to cover up fundamental differences, not only between regions, but be-

Table 18 –Federal coal leases in Known Recoverable Coal Resource Areas (KRCRA's), 1978

State[1]	Federal coal land in KRCRA's					Non-Federal coal area[3, 7]	Total area of KRCRA[4]
	Areas leased[2]	Preference-right lease applications[2]	Unleased area[3]	Total Federal coal land[4, 5]	Percent unleased[6]		
	1,000 acres				*Percent*	*1,000 acres*	
Montana	36.1	3.7	2,136.7	2,176.4	98.2	1,206.0	3.382.4
North Dakota	14.8	0	798.2	813.0	98.2	1,765.2	2,578.2
Wyoming	189.2	139.4	4,180.0	4,508.6	92.7	1,649.7	6,158.2
Total, Northern Great Plains[4]	240.1	143.1	7,114.8	7,497.9	94.9	4,620.9	12,118.9
Colorado	82.3	39.2	994.6	1,116.0	89.1	711.3	1,827.3
New Mexico	41.0	78.0	1,725.5	1,844.5	93.5	402.7	2,247.2
Utah	221.7	74.6	649.1	945.4	68.7	170.7	1,116.1
Total, Rocky Mountain	345.0	191.7	3,369.2	3,905.9	86.3	1,284.7	5,190.6
Total, Western Region	585.1	334.8	10,484.0	11,403.9	91.9	5,905.6	17,309.5

[1] Data on leasing are not available by CPA's.
[2] From U.S. Bureau of Land Management (97).
[3] Column 4 minus columns 1 and 2.
[4] Data may not add to total because of rounding.
[5] From table 17.
[6] Column 3 divided by column 4 times 100.
[7] Includes State, Indian, and private ownership.

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[29] In this section, all statistics on agriculture are from the 1974 Census of Agriculture, the latest available source of data by county. Although the information is outdated, it is accurate enough for valid comparisons between CPR's and CPA's.

tween CPA's within regions, and even within the CPA's themselves.

The land in the Interior Region, consisting of 73 million acres, is mostly in farms; most of this farmland is cropland, and most of the cropland is harvested. No other CPR has such an intensive use pattern for its agricultural land. There are significant differences within the region. IL-1, IL-2, IL-3, IL-4, and IA-2 all have more than 75 percent of the land area in farms; more than 75 percent of the farmland is cropland, and more than half the land area was cropland harvested (app. tables 5 and 6). These five CPA's are outstanding because the soil and topography are eminently suited to agriculture, especially row crops such as corn and soybeans. In AR-1, however, only one-third of the land is in farms, and less than one-fifth of the farmland is used for harvested crops. Again, the reasons are soil and topography. A large part of AR-1 is in the Ozark Mountains, an area unsuited to large-scale crop production.

The Northern Great Plains Region is second to the Interior in land use intensity. More than 80 percent of the land is in farms but nearly 75 percent of the farmland is pasture and range; only about 13 percent of the land area is harvested cropland (table 21). Again, the averages for the region cover up some significant differences between CPA's. The three North Dakota CPA's and MT-1 have relatively more cropland than any of the others. Most of the land in Wyoming CPA's and in MT-3, MT-4, and MT-5 is used for pasture and range.

Table 19—Coal production from Federal leases, six Western States[1]

Region and State	Coal production		
	Total	From Federal leases	Federal leasing share
	Million tons		*Percent*
1957 Six States	15.7	4.4	28
1962 Six States	14.0	4.9	35
1967 Six States	21.2	6.5	31
1972 Six States	44.4	8.8	20
1973 Six States	53.3	12.9	24
1974 Six States	64.4	21.5	33
1975 Six States	78.3	31.0	40
1976 Six States	95.3	38.1	40
1977 Six States	116.9	51.6	44
Montana	27.2	10.5	39
North Dakota	12.0	.7	6
Wyoming	46.0	28.3	62
Northern Great Plains Region	85.2	39.5	46
Colorado	12.0	4.0	33
New Mexico	11.1	2.3	21
Utah	8.6	5.8	67
Rocky Mountain Region	31.7	12.1	38

[1] States identified under 1977 entry.

Sources: (*90, 96*, tables 2-8 and 2-9; *103, 105*).

Half the area of the Gulf Region is farmland, of which about one-third is cropland. Less than one-third of the cropland was harvested for crops and nearly two-thirds was used only for pasture. There is more farmland in TX-1 than in any other CPA in the region.

The Eastern and Pacific Regions have the least farmland of any; 26 percent and 12 percent, respectively, of the land area is in farms. Much of the Eastern Region is within the area commonly called Appalachia, where the terrain is mostly mountainous, with relatively little land suitable for any kind of farming. In some CPA's, such as KY-4, KY-5, and WV-5, less than 15 percent of the land area is in farms. In all the CPA's in Kentucky, West Virginia, Tennessee, and Virginia, very little is cropland and much of this is used only for pasture, suggesting that its agriculture is far from intensive.

The Pacific Region, consisting of CPA's in Washington and Alaska, is difficult to characterize. Large parts of the CPA's in Washington are included within the Cascade Mountain range, although the land in a few areas of considerable size is well suited to agriculture. Much of the cropland depends on irrigation, especially in the eastern portion of WA-2, where the climate is arid. The Alaska portion of the region is cold and is ill-suited to any type of agriculture; hence, there is little farmland, and only a small part of it is used for harvested crops.

Crops Produced

The kind of crops produced in any area is a function of climate, soil, and topography; and the cropping pattern shows the intensity of land use. In the Northern Great Plains, wheat is by far the most important crop; it accounts for 55 percent of the cropland harvested in that region and leads all other crops in seven of the CPA's (table 22 and app. table 7). Hay is next in acreage with 28 percent; it is the leading crop in six CPA's and second in acreage in six others. The third crop in acreage is small grains. In every CPA the three leading crops are wheat, small grains, and hay—although not necessarily in that order.

The Rocky Mountain Region has a wider variety of crops. Hay has the largest acreage—38 percent—followed by wheat with 35 percent and corn with 13 percent. Most of the wheat is grown on dry land in northeastern Colorado (CO-7), Table 20–Land area and major land use in Coal Production Areas (CPA's), 1974[1]

Region	Land Area	Nonfarm land	Land in farms							
			Cropland				Wood-land	Pasture, range, and other	Total	Irri-gated
			Har-vested	Pasture	Other	Total				
	1,000 acres									
Northern Great Plains	77,003	14,846	9,922	1,590	5,641	17,152	910	44,095	62,157	660
Rocky Mountain	90,728	42,896	1,991	762	926	3,679	6,090	38,063	47,832	1,436
Interior	73,014	16,673	31,500	7,694	1,707	40,900	5,064	10,377	56,341	78
Eastern	56,943	41,980	3,744	3,026	572	7,342	4,678	2,944	14,964	9
Gulf	24,476	12,325	1,510	2,952	269	4,730	2,806	4,616	12,152	78
Pacific[2]	7,286	6,380	197	134	13	344	171	391	905	114
Total, all CPA's[2]	329,450	135,099	48,864	16,158	9,128	74,147	19,719	100,486	194,351	2,375
	Percent of total acres									
Northern Great Plains	100	19.3	12.9	2.1	7.3	22.3	1.2	57.3	80.7	0.9
Rocky Mountain	100	47.3	2.2	.8	1.0	4.1	6.7	42.0	52.7	1.6
Interior	100	22.8	43.1	10.5	2.3	56.0	6.9	14.2	77.2	.1
Eastern	100	73.7	6.6	5.3	1.0	12.9	8.2	5.2	26.3	–
Gulf	100	50.4	6.2	12.1	1.1	19.3	11.5	18.9	49.6	.3
Pacific[2]	100	87.6	2.7	1.8	.2	4.7	2.3	5.4	12.4	1.6
Average[2]	100	41.0	14.8	4.9	2.8	22.5	6.0	30.5	59.0	.7

Note: Data may not add to total because of rounding.

– = Less than 0.05 percent.

[1] For detail by CPA, see appendix table 5.

[2] Excludes Alaska.

Source: (*84*).

Table 21–Land use ratios for Coal Production Areas (CPA's), regional averages, 1974[1]

Region	Farmland to land area	Cropland to farmland	Harvested cropland to total cropland	Harvested cropland to land area
	Percent			
Northern Great Plains	80.7	27.6	57.8	12.9
Rocky Mountain	52.7	7.7	54.1	2.2
Interior	77.2	72.6	77.0	43.1
Eastern	26.3	49.1	51.0	6.6
Gulf	49.6	38.9	31.9	6.2
Pacific[2]	12.5	37.9	57.3	2.7
All CPA's average[2]	59.0	38.2	65.9	14.8

[1] For detail by CPA, see appendix table 6.

[2] Excludes Alaska.

Source: (*84*).

whereas most other crops require irrigation. Hay is the leading crop in all but two of the CPA's in the Rocky Mountain Region, and a large part of it is irrigated alfalfa. Corn is second in acreage in six of the CPA's and third in three. Other crops of importance include small grains, sorghum, dry beans, and vegetables.

Most CPA'S of the Interior Region are located within the Corn Belt, where corn is the leading crop, with 40 percent of the harvested acreage. Soybeans are next with 36 percent. Corn and soybeans together are the two most important crops in 14 of the 24 CPA's, including all those in Illinois, Indiana, and Iowa as well as KY-1, MO-2, and MO-3. Hay, sorghum, and wheat are among the leading crops in some of the CPA's.

Throughout the Eastern Region, hay is the dominant crop, at least in acreage. Hay is first and corn is second in acreage in each of the CPA's, except AL-1, where corn is first. Small grains, wheat, or tobacco are third in acreage in most of the CPA's. The economic importance of tobacco is greater than indicated by the acreage figures because of its high value per acre.

Hay, sorghum, and corn are the leading crops in acreage in the Gulf Region. Cotton is third in acreage in three CPA's, namely, AR-2, TX-1, and TX-3, but it probably ranks higher than third in economic importance because of its relatively high returns per acre.

Hay is by far the leading crop in the CPA's of the Pacific Region, with about 72 percent of the total acreage. Vegetables are important in the Washington CPA's. The climate of Alaska is so severe that only short-season crops are grown, including hay, small grains, and potatoes.

Farm Income

The gross value of farm products sold is used here as an indicator of income potential.[30] We recognize that net income might be a more appropriate measure, but such data are available only at the State level.[31] In all six regions, the aggregate farm income was $10.9 billion in 1974, divided about equally between crops and livestock (table 23). About 66 percent of the income in the Northern Great Plains and Interior Regions was from crops; in each of the other regions, about 75 percent was from livestock. Nearly two-thirds of the total, $6.8 billion, was from the Interior Region, while the Eastern Region produced $1.3 billion.

Nearly all the income—98 percent—came from "commercial farms," defined for this report as those with more than $2,500 gross income.[32] The average income per farm ranged from $23,717 in the Eastern Region to almost $80,000 in the Rocky Mountain Region.

Agricultural intensity can be measured by the average value of farm income per acre. The Interior was the most intensive region with $92.84 per acre of land area or $120.31 per acre of farmland. The least intensive, by either measure, was the Rocky Mountain Region.

Table 22—Three leading crops in each Coal Production Region, 1974

Region	Cropland harvested[1]	First		Second		Third	
	1,000 acres	*Crop*	*Percent*	*Crop*	*Percent*	*Crop*	*Percent*
Northern Great Plains	9,922	Wheat	55.2	Hay	28.2	Small grains[2]	14.3
Rocky Mountain	1,991	Hay	38.2	Wheat	34.8	Corn	12.6
Interior	31,500	Corn	40.4	Soybeans	36.2	Hay	11.1
Eastern	3,744	Hay	50.7	Corn	29.0	Small grains[2]	8.1
Gulf	1,510	Hay	41.2	Sorghum	15.6	Corn	11.7
Pacific	214	Hay	71.9	Vegetables	10.6	Corn	5.4

[1] Data may not add to total because of rounding.
[2] Small grains include oats, barley, rye, and mixed grains.

Source: (*84*).

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[30] The term "farm" is used in its broad sense to include livestock ranches.

[31] For convenience the term "income" is used in this section, but with the understanding that it represents gross sales of farm products.

[32] The term "commercial" is used here for convenience only; it is not intended to suggest that all farms in the group are capable of supplying agricultural products for market in "commercial" quantities.

Some important interregional variations are hidden by the averages in table 23. In the Northern Great Plains, 8 of the 13 CPA's had more income from livestock than from crops, although about 41 percent of the regional average was from livestock (app. table 8). In one CPA, ND-1, crop income was $241 million, which is more than four times the livestock income, and it represents about 41 percent of the total crop income of the region. ND-1 also had the most intensive agriculture in the region, $30.78 gross income per acre. The lowest intensity was in the four Wyoming CPA's and the two westernmost CPA's in Montana, all of which had less than $10 income per acre.

The Rocky Mountain Region also had wide variations from one CPA to another. CO-7 had a total income of $726 million, which was 75 percent of the regional total. The average income was nearly $98 per acre and $145,000 per farm. Most of this high income in CO-7 was from Weld County, where there are many large cattle-feeding operations, at least one of which is noted for its size and high degree of vertical integration.

In all the other CPA's, the income per acre was relatively low, ranging from $0.67 in UT-2, and $1.03 in AZ-1 to $5.33 in CO-2 and $8.15 in CO-4. In AZ-1, NM-1, and NM-2, much of the land is in Indian reservations and is largely devoted to extensive livestock grazing. Reservations are counted as "farms" by the Census, but they are classified as "abnormal" and not included with the "commercial" farms. In these three CPA's, the "other" farms were much larger than in other CPA's (both in acreage and income) because the group included the "abnormal" farms.[33]

Income in the CPA's of the Interior Region was much more uniform and substantially larger than in the other regions. Income per acre was much higher than in any other region; in fact, income per acre in the three lowest-income CPA's in the Interior (the three in Oklahoma) was higher than in most CPA's in other regions. All the CPA's in Illinois, Indiana, and Iowa had higher income per acre than any other, except CO-7. Crop income was larger than livestock income in most of the CPA's, including all those in Illinois and Indiana.

Income per farm exceeded $44,000 in AL-1 and was the highest of any CPA in the Eastern Region.[34] Next was PA-2 with over $31,000. The lowest were WV-4 with $6,670 and KY-3 with $9,564. Average income per acre was $49 in OH-1; next was PA-1 with almost $26. The lowest income per acre was in KY-4 and KY-5, but WV-4, WV-5, and WV-6 were all less than $5 per acre. In each CPA in the latter group, less than a third of the places classified as farms are commercial farms by the definition used here, and less than 20 percent of

Table 23–Gross farm sales: Total, per farm and per acre, by region, 1974

Region	From livestock	From crops	Total	Commercial farms	Other farms	Income per commercial farm	Average per acre of–	
							Land	Farmland
	1,000 dollars					Dollars		
Northern Great Plains	407,948	590,742	998,693	994,988	3,705	40,552	12.97	16.07
Rocky Mountain	731,879	235,165	967,047	942,930	24,117	79,950	10.66	20.22
Interior	2,676,441	4,102,238	6,778,673	6,718,930	59,743	39,069	92.84	120.31
Eastern	922,592	350,324	1,272,902	1,207,868	65,034	23,717	22.35	85.07
Gulf	476,607	158,726	635,334	604,887	30,447	28,441	25.96	134.32
Pacific	153,139	52,217	205,360	201,871	3,489	55,689	[1]27.30	[1]219.80
Total or average	5,368,606	5,489,412	10,858,009	10,671,474	186,535	37,559	[1]32.94	[1]55.83

[1] Excludes Alaska.

Data may not add to total because of rounding.

Source: (*84*).

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[33] "Abnormal" farms, so called by the Census because they bear little resemblance to the typical family farm in management or organization, include experimental farms and institutional farms as well as Indian reservations.

[34] In AL-1, 82 percent of the livestock income was from large poultry farms; in one county in AL-1, 91 percent of the income was from poultry.

these have gross incomes of $20,000 or more (*84*). Most of the people living on farms in this area had some source of off-farm income; those who do not are likely to be living below the poverty level. This low level of agricultural income is due primarily to lack of resources; the topography is mountainous and little land is level enough to be suited for crop production.

Farm income in the Gulf Region and the Washington portion of the Pacific Region averages $26 and $27 per acre, respectively, and not as much variation occurs between CPA's as in other regions. Alaska, however, has so few farms and so much nonfarm land that the income per acre of land area was very low; it varied from 1 cent to 12 cents per acre. The gross income per farm ranged from about $12,000 in AK-4 to nearly $42,000 in AK-3. There were no farms in AK-1, as it is too far north for successful production of even the hardiest crops.

Competition for Land Resources

A concern frequently expressed in connection with coal development is the effect of strip mining on the supply of farmland, sometimes coupled with the fear that continued increases in strip mining might jeopardize the national (or world) food supply. In this section, we attempt to assess the effect of expected increases in surface mining of coal on land use and farm production. To do so, however, we must make numerous assumptions as to the nature and magnitude of future events and the impact of these events on the resource base.

The obvious starting place, but perhaps the most difficult, is projecting the amount and location of surface mining activity. One way to project coal production is to aggregate the future plans of mining companies. By combining data from several sources, we projected average annual coal production from strip mines for 1975-99 (*7, 44, 92*). These projections represent actual production data for 1975-77,[35] estimated production for 1978-79,[36] and expansion intentions for 1980-99. Results show an annual average of 746 million tons to be produced by strip mining for the period, with 296 million tons (or 40 percent) from the Northern Great Plains (table 24). The Eastern Region would be second with 205 million tons or about 27 percent of the total. Among the CPA's, two are outstanding in projected production, and both are in the Powder River Basin; they are WY-2 with 142 million tons and MT-4 with 58 million tons (app. table 9). Three other CPA's are worthy of mention–PA-2 with 41 million tons, TX-1 with 34 million tons, and KY-1 with 32 million tons. These five CPA's would account for 41 percent of the total strip-mined coal in the United States during the 25 years.

Concerning the above projections, two points are worth noting. First, there are a few CPA's with substantial strippable reserves where little or no strip mining is projected, for example, MT-2, MT-5, AL-2, and AK-1. Second, in some CPA's, the average annual projected production is much larger than current production, which suggests substantial growth during the period. Such is the case in WY-2 MT-4, and some others.

The next step is to establish a relationship between coal production and land use. In strip mining there is a consistent inverse relationship between seam thickness and acreage actually mined. This relationship may be expressed as coal yield per acre, which ranges from 2,000 tons or less in some CPA's in Kansas and Oklahoma to more than 100,000 tons in WY-2, where coal seams are sometimes 100 feet thick and the average for the CPA is 71 feet.[37] Regional averages, which only generally indicate relative coal yield, range from about 5,000 tons per acre in the Interior and Eastern Regions to 47,870 tons per acre in the Northern Great Plains Region. To produce a million tons of coal from a seam of average thickness in WY-2 would require 9.9 acres, whereas in AR-1, AL-1, or KS-3, it would take 333 acres.[38] These calculations show the amount of land disturbed to produce a given amount of coal, but to estimate the impact on agriculture, one must account for the fact that each acre disturbed will be out of production until the land is reclaimed and restored to use. Although authorities are not fully agreed as to the length of time required for land reclamation, they assume the time would be longer in areas of low precipitation than in more humid areas (*22, 41, 52*). In computing the data in tables 24 and appendix table 9, we arbitrarily assumed that 10 years would be required in the Rocky Mountain Region, 8 years in Montana and Wyoming, and 5 years in all other areas.

In addition to the land disturbed by the mining process, each mine needs land for permanent facilities, such as coal storage and loading areas, parking lots, shops, offices, roads, and in some cases, railroad spurs or loops. We assume that land used for such purposes is not reclaimed but remains out of production for the entire study period. Data on the area required for such facilities are fragmentary and generally inconsistent, so it was necessary to make an arbitrary allowance. For each new or expanded mine, we assumed 800 acres for the Northern Great Plains, Rocky Mountain, and Pacific Regions, 600 acres in the Interior and Gulf Regions, and 400 acres in the Eastern Region.

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[35] Data by counties were available for 1975-77, so production by CPA's could be obtained by a simple process of aggregation (*44*).

[36] Available by States, but not by counties (*90*).

[37] The data used here are averages for each CPA and are based on a recovery factor of 80 percent. In practice, the recovery factor may exceed 80 percent in the thick seams.

[38] One million divided by coal yield per acre.

The resulting calculations from all the above assumptions indicate an annual average of 568,300 acres would be out of production during 1975-99, the assumed period of analysis.[39] The largest acreage would be in the Eastern Region, about 225,000 acres. In the Interior Region, about 132,000 acres would be out of production annually. The largest such acreage in any CPA is 45,500 acres in PA-2; AL-1 is next with 32,800 acres, and KY-1 is third with 31,880 acres.

Expressing such losses of land in dollars enables one to gain more perspective in judging their significance. To do this, we assume that in every CPA land used for mining is equal to the average of the CPA and that its production can be expressed as annual gross farm sales per acre of land area, as shown in table 24 and appendix table 9. Thus, the value of farm production displaced in all the CPA's would be about $16 million a year, of which nearly $10 million would be in the Interior, about $4 million in the Eastern, and less than $1 million in each of the other regions (1974 prices are assumed). There are six CPA's where the loss would be more than $1 million dollars annually; collectively this group of six accounts for $9.4 million, or 58 percent of the total. Two of the high CPA's are in Illinois; there is one each in Indiana, Kentucky, Ohio, and Pennsylvania. These CPA's as a group have three common characteristics; they produce large amounts of coal, the coal seams are thin (relative to the western CPA's), and the value of farm production per acre is relatively high. Two of the western CPA's (MT-4 and WY-2) are expected to produce much more coal than any of the above six, but the value of farm production displaced is low in the West because coal yield per acre is high and the value of farm production per acre is relatively low.

Comparing production displaced with the value of normal farm output in the study area is another way to gain perspective. The value of all farm production in the six regions was about $10.9 billion. The production displaced in the same area is only $16 million, or 0.15 percent of the total. The largest relative loss of productivity is in the Eastern Region–0.33 percent. In the Northern Great Plains, where coal produced from strip mining is largest, the loss of farm production is only 0.09 percent of the total. In a few CPA's, however, the ratio is much higher, especially in KY-4 (1.41 percent), KY-5 (1.17 percent), IN-2 (0.87 percent), and KY-1 (0.83 percent). In the two Kentucky CPA's, the ratio is high because there is relatively little farmland; hence, the productive base is low, and to lose even a little farm production results in a higher ratio.

Table 24–Projected coal production from surface mines, land used for mining, and value of farm production displaced, 1975-99

Coal Production Region	Average annual coal production, 1975-99	New or expanded mines	Coal yield per acre[1]	Average annual land acreage used for coal production	Annual value of production displaced		Ratio[2]
					Per acre	Total	
	Million tons	*Number*	*Tons*	*1,000 acres*	*Dollars*	*1,000 dollars*	*Percent*
Northern Great Plains	296	66	47,870	103.6	9.06	939	0.09
Rocky Mountain	66	27	16,280	66.9	2.76	185	.02
Interior	116	30	5,040	132.6	73.64	9,762	.14
Eastern	205	34	5,520	225.9	18.65	4,212	.33
Gulf	58	12	[3] 10,220	37.8	26.32	995	.16
Pacific	6	2	[4] 31,150	1.6	22.52	35	.02
Total/average	746	171	na	568.3	28.38	16,126	.15

na = Not available.
[1] Average for all strippable reserves in the region.
[2] Value of production displaced as a percentage of all farm production in the CPA's of the region.
[3] Includes Texas only.
[4] Includes Washington only.

Source: Appendix table 10.

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[39] This would be acreage in addition to that disturbed in years prior to 1975 and includes future land use for old mines as well as for new and expanded ones.

Strip mining of coal is not a serious threat to food supplies from a national or regional viewpoint, if the assumptions used in our analysis are reasonable. Neither is there any serious reduction in aggregate farm output in any given CPA, particularly not in those where a strong farm economy exists. Two caveats are in order, however. First, we assumed that the land used for mining was equivalent in productive capacity to the average acre in the CPA, not the average for farmland. If all or most of the mining in a particular CPA were to take place on farmland alone, the resulting estimates of value would likely be much higher, especially where the ratio of farmland to land area is relatively low, as in the Eastern Region. Second, even though the loss of farm productivity is relatively insignificant in the aggregate, it may be highly significant to a particular landowner or a local community. The person who loses a major part of his or her farm to a strip mine might find little consolation in the knowledge that the average loss for the CPA was an insignificant percentage, particularly if he or she believes that the reimbursement received for disturbing his or her operations is inadequate. Although it is important to recognize that the aggregate agricultural losses to strip mining are insignificant at the national or regional level, it is also true that local losses may be serious, and the impacts on a few farms may be severe.

Water

Coal development is sometimes regarded as a threat to water supplies, in terms of quantity or quality or both. Competition for water with other kinds of development varies greatly within and between regions. Water supplies may be affected in a number of ways. Water use is measured in two ways, either by the amount diverted from a stream or an aquifer, or by "consumptive use," the amount consumed or "used up" by the activity or facility in question. Consumptive uses include cooling and boiler water for coal-fired electric generators, water used as feedstock for coal gasification, and water used in the mining processes. Slurry pipelines transfer water from one location to another, probably outside the basin of origin. Thus, the effect would be similar to a consumptive use as far as the basin is concerned. Changes in water quality occur from acid mine drainage, from thermal pollution which results from discharge of cooling water, and from the impurities remaining after the coal from a slurry pipeline is dewatered. Water supplies could be destroyed or interrupted when a strip mining operation blocks or alters the course of a stream, cuts through an aquifer, or destroys one. In many locations the coalbed itself may be an important aquifer.

The manner in which coal development affects water supplies is site-specific, and the severity of the resulting competition for water supplies varies tremendously from one area to another. Thus, most research on the impact of coal development on water supplies has been regional or local. One significant exception is "A Nationwide Assessment of Water Quality Impacts on the National Energy Plan" (NEP), a study conducted at the Oak Ridge National Laboratory (*16*). The principal conclusion was that, by 1985, the aggregate impact of all projected energy development, including coal, will increase consumptive water use by less than 1 percent of the U.S. water supply (fig. 7).[40] Although this conclusion is generally valid, it tends to cover up some important regional water problems associated with coal development, which we discuss below.

The actual quantity of water required for any particular coal conversion facility depends greatly on a number of site-specific variables, and in most cases, the amount of water withdrawn from the stream greatly exceeds the amount of consumptive use. Some generalizations are possible, however. The Nationwide Assessment used the following estimates of water withdrawn and consumed in projecting annual water requirements (*16*, except as noted):

Method	Water quantity	
	Withdrawn	Consumptive use
	Acre-feet	
Thermogenerators, 1,000 MW:[1]		
Once through cooling	930,800	4,500
Cooling pond	29,100	17,900
Wet cooling tower	20,200	12,300
Dry cooling tower	1,300	1,100
Coal gasification, 250 MMcfd[2]	21,300	17,900
Coal liquifaction, 50,000 bbl/day	22,400	22,400
Slurry pipeline, 5 million tons[3]	3,000	not available

[1] Megawatts. A megawatt equals 1,000 kilowatts.
[2] Million cubic feet per day.
[3] From Yellowstone Level B Study (*47*, table 21).

Regional Water Supplies

In a few areas in Wyoming and Montana, and in most of the Colorado River basin, surface water supplies are so scarce that added competition for water from coal development could become a serious problem. However, in the East and Interior, new coal facilities would use only a small portion of available surface water supplies.

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[40] The Aggregated Sub Areas (ASA) shown in figure 7 are those established by the Water Resources Council.

The Northern Great Plains Region. This region is characterized by low to moderate precipitation patterns, with wide variations from season to season, year to year, and place to place. Therefore, water supplies vary widely, both seasonally and geographically. Nearly all CPA's in the region are located in the basins of the Missouri River and its tributaries, the most important of which is the Yellowstone. An exception is ND-1, part of which is drained by the Souris River into Canada, and another is WY-4, most of which drains into the Green River and then into the Colorado.

The availability of water for energy development in the Northern Great Plains has been the subject of several studies in recent years (*23, 47, 56, 99, 110, 112*). These studies have generally indicated that there is plenty of water in the region to supply the needs of coal development but that problems of storage, transfers between sub-basins, or institutional barriers to water use may arise in local situations. Irrigation is by far the largest user of water in each of the river basins in the Northern Great Plains, accounting for nearly 5 million acre-feet (maf) out of a total of 7.5 maf (table 25). Thus, it follows that where conflicts for the use of water arise, agriculture will be one of the major claimants. Evaporation from large reservoirs is also important but cannot be controlled effectively with current technology. The remaining competing uses include municipal, industrial, and livestock watering, as well as energy development.

The "remaining flows" shown in table 25 are annual averages, whereas the controlling quantities are likely to be the lowest flows that could be reasonably expected during a water-short season (critical year flows). In addition, certain minimum instream requirements must be met to satisfy all claims to the flow of a given stream.[41] In several streams in the Northern Great Plains, the claimed instream requirements are substantially larger than the critical year flows. For example, in the Tongue and the Powder Rivers, the instream requirements claimed are more than three times the critical year low flows (table 26).

The most intensive coal development in the Northern Great Plains is likely to take place in two principal areas—in the Tongue-Powder Basins in Wyoming (WY-2 and MT-4) where water is short and in North Dakota on both sides of Lake

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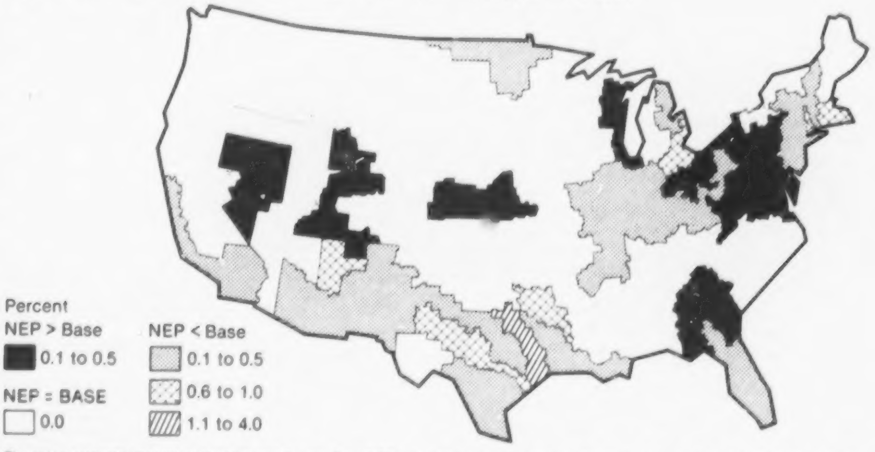
[41] The extent to which instream requirements can be enforced legally is still unsettled.

Figure 7

Water Resource Impacts of the 1977 National Energy Plan (NEP)



The water resource impacts of the National Energy Plan (NEP) are almost identical to the 1985 Base Case. Water consumption by all energy facilities as a percentage of the surface supply varies by less than 1 percent (of the supply) in every Aggregated Subarea except the Trinity River Basin in Texas (▨).

Table 25–Estimated level of streamflow depletions and remaining average annual flows, 1970

Depletion or flow	Upper Missouri	Yellow-stone	Western Dakota	Eastern Dakota	Main stem	Wyoming Platte[1]	Wyoming Green[1]	Total
	1,000 acre-feet per year							
Irrigation	1,480	1,987	427	256	0	577	242	4,969
Large reservoir evaporation	168	100	43	6	1,586	[2] 179	[2] 26	2,109
Other	124	87	105	64	0	20	28	428
Total depletions	1,772	2,174	575	326	1,586	777	296	7,505
Remaining flows	7,276	8,800	2,430	3,235	–	988	2,022	24,751

[1] Depletion levels and remaining flows in 1968.
[2] Includes evaporation other than that of large reservoirs.

Source: (*23*).

Table 26–Average annual flow of surface water remaining for use, 1970

River	Critical year flow	Average annual flow	Instream requirements
		Acre feet	
Yellowstone Basin:			
Clarks Fork	538,000	767,000	207,800
Wind Bighorn	1,429,000	2,550,000	1,527,600
Tongue	32,000	304,000	148,500
Powder	43,000	416,000	162,500
Yellowstone (near Sidney)	3,720,000	8,800,000	4,083,800
Upper Missouri Basin:			
Missouri at North Dakota Border	na	7,276,000	na
Missouri at Lake Sakakawea	na	16,952,000	na
Missouri at Oahe Reservoir	na	18,525,000	na
Western Dakota Territories:			
Little Missouri	35,000	390,000	184,800
Knife	3,000	118,000	61,700
Heart	17,000	154,000	70,000
Cannonball	1,000	149,000	68,300
Grand	9,000	156,000	44,800

na = Not available.

Source: (*55*, p. 13).

Sakakawea (ND-1 and ND-2) where water is plentiful.[42] In the former area, large quantities of water could be made available for energy development only by constructing more storage facilities or by interbasin transfers (*47, 56*). Fortunately, much of the coal produced in this area is expected to be shipped by rail to plants outside the region, so only a minimum amount of water will be required. Some coal companies plan to transport coal by slurry pipeline, in which case larger quantities of water will be required, and the water would be taken out of the basin of origin. Controversies over the right to use water in this manner will continue.[43]

Most of the new or expanded coal development in North Dakota is expected to take place near the main stem of the Missouri River where water can be obtained either from the river itself or from Lake Sakakawea (*99*). Thus, physical availability of water is not problem, although some institutional barriers may arise.

Rocky Mountain Region. The entire Rocky Mountain Region is water scarce—a fact likely to affect the rate of coal development. The principal drainage system in the region is the Colorado River, which drains all of Arizona, eastern Utah, western Colorado, and some of western New Mexico. Other drainage systems are the Missouri (northeastern Colorado), the Arkansas (southeastern Colorado and part of eastern New Mexico), and the Rio Grande (central part of New Mexico). The Great Basin, which includes western Utah, has no outlet to the sea.

The Colorado River Basin is peculiar because, although most of the water originates in the upper part, it is largely used in the lower part.[44] Estimating the future availability of surface water for potential energy development in any river basin is difficult because of institutionally imposed uncertainties, varying estimates of use (current and projected), and varying estimates of available supplies. Each of these uncertainties seems to be magnified on the Colorado River, which is one of the most difficult systems in any of the CPR's to analyze. Institutional factors which complicate analysis include the Colorado River Compact of 1922, which allocates 7.5 maf to the lower basin States; the Mexican Treaty of 1945, which guaranteed to Mexico an annual average of 1.5 maf; and the Upper Colorado River Compact of 1948, which provides the basis for dividing available water among the upper basin States (*59, 107, 108, 124*).

Another factor complicating the analysis is the difficulty of establishing just how much water is in the river and how much is available for current and future uses. One report states that:

> The original division of upper and lower basin allocations was based upon an assumed 10-year annual flow exceeding 18 maf. . . . However, as late as 1974 some agencies were using an assumed flow of 15 maf. . . . The U.S. Bureau of Reclamation has provided estimates ranging from 13.2 maf to 15.5 maf with a value of 14.1 maf being given as the most probable status.[45] . . . However, nature provided an average runoff of only 11.6 maf for the period 1954-63. This divergence between estimates sets bounds on water availabilities and also makes it apparent that individual states can easily arrive at differing estimates of their own water allocations. (*23*)

States do indeed arrive at differing estimates, and water supplies throughout the region have been the subject of continuing controversy. The issues are so complicated that they are beyond the scope of this report; suffice it to say that no agency can afford to assume that water could be made available for any specific coal development or facility. One set of projections of future flows and use (or depletions) shows that about three-fourths of the upper Colorado supply now flows out of the upper basin at Lees Ferry. Most of the depletions (2.1 maf out of 14.9 maf) go to Colorado, with small amounts to Utah and the other upper basin States (table 27). Of the lower Colorado supply, 14.3 maf, more than half goes to main stem depletions, much of which is used in California, while 5.4 maf (or about 38 percent) is used in Arizona. Only about 1 maf (or 7 percent) flows out of the United States to Mexico. Projected depletions for 2000 and 2020 could not be met because they would result in a "negative" outflow at the Mexican border, an obvious impossibility. Some of the projected claims will obviously be reduced or eliminated. The situation is confused further by the assumption that the Upper Colorado supply is indeed 14.9 maf. If it were only 13.3 maf, as suggested in the paragraphs we have quoted, there would be no current outflow to Mexico and a deficit of 0.6 maf would result. By the year 2020, the deficit would increase to 2.8 maf.

Most of the water supplies are now being used for irrigation, because crops in most of the region require irrigation water to supplement normal precipitation. In the Upper Colorado 74 percent of all stream depletion is used for irrigation, while in the Lower Colorado nearly 90 percent is thus used (table 28). Thermal electric power uses less than 2 percent of the total depletion in the upper basin and only 0.2 percent in the lower basin. Projections of future depletions are based on the expectation that most of the water will continue to be used for irrigation.

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[42] Lake Sakakawea is the reservoir formed by the construction of Garrison Dam on the main stem of the Missouri River.

[43] In the Yellowstone Level B study (*47*) it was assumed that, with high-level development, about 25 percent of the coal from the Tongue-Powder River areas would be transported by pipeline.

[44] The dividing point between the Upper and Lower Colorado is at Lees Ferry in Arizona near the Colorado border.

[45] This sentence refers to a 1975 report of the Bureau of Reclamation; see (*109*).

The foregoing strongly suggests that surface water for major energy projects will not likely be available except by diversion from other uses.[46] Because irrigation is the major use, it is likely that interests seeking water for energy will look toward agriculture as a potential source of supply. However, there are major institutional barriers, such as prior rights, water compacts, and international treaties, which would tend to prevent transfers from irrigation to energy development. There is a possibility, however, that ground water mining might become a means to overcome water deficits for some uses and in some areas (*23*).

Table 27–Projected supply and depletions, Colorado River Basin

Location	Current[1]	1980	2000	2020
	Million acre feet (maf)			
Upper Colorado, virgin supply	14.9	14.9	14.9	14.9
Less depletions by:				
Arizona	*	.1	.1	.1
Colorado	2.1	2.4	3.1	3.1
New Mexico	.3	.5	.6	.7
Utah	.8	.9	1.1	1.2
Wyoming	.4	.5	.7	.7
Residual outflow, Lees Ferry	11.2	10.5	9.3	9.2
Plus virgin supply originating in the lower basin	3.1	3.1	3.1	3.1
Lower Colorado supply	14.3	13.6	12.4	12.3
Less depletions by:				
Arizona	5.4	6.2	5.9	6.4
Nevada	.3	.4	.5	.7
New Mexico	.1	.1	.2	.2
Utah	.1	.1	.1	.1
Main stem[2]	7.5	6.5	6.1	6.1
Residual outflow	1.0	.3	−.3	−1.2
Residual outflow, assuming Upper Colorado supply of 13.3 maf instead of 14.9 maf	−.6	−1.3	−1.9	−2.8

* = Less than 0.05 million acre feet.

[1] 1974-76 data.

[2] Exported from the basin.

Source: (*23*).

The Interior Region. The coal production areas of the Interior Region are in four river basins, each part of the Mississippi River system. The four basins are the Upper Mississippi, the Ohio, the Missouri, and the Arkansas-White-Red. According to the National Assessment of Water Quality Impacts (*16*), the average low flows of the Ohio and Upper Mississippi Rivers are more than adequate for all projected consumptive use for energy. Energy-related uses would consume a maximum of 6 percent of the low flow of any tributary of the Ohio River and a maximum of 5 percent in the Upper Mississippi. There is little need for concern about water availability in these two basins, except at specific sites. About 88 percent of the region's coal resources are located in these two river basins.

In the Missouri Basin supplies are less plentiful, and in years of low flow, some smaller streams may develop shortages for steam electric facilities. The same situation exists in the Arkansas-White-Red Basin, especially the western part. However, only a small part of the region's coal reserves are located in those two river basins; hence, development will be limited. Surface water supplies are not expected to hinder coal development in the region.

The Eastern Region. Surface water supplies are generally plentiful throughout the Eastern Region; it has been referred to as a "water rich" area. For current coal production and processing, there seem to be no shortages of surface water in any of the CPA's (*16*). At some future date, water supply problems might possibly emerge on streams such as the Allegheny or the Monongahela if all existing and proposed plants

Table 28–Colorado River depletions, by type[1]

Type	Upper Colorado		Lower Colorado[2]	
	Maf	*Pct.*	*Maf*	*Pct.*
Municipal and industrial	38	1.3	198	3.4
Thermal electric	50	1.7	10	.2
Minerals	48	1.6	52	.9
Fish and wildlife	36	1.2	110	1.9
Recreation	14	.5	4	.1
Livestock	53	1.8	[3]	[3]
Evaporation	520	17.8	230	4.0
Irrigation	2,159	74.0	5,226	89.6
Total depletions[4]	2,918	100.0	5,830	100.0

[1] 1974-76 data.

[2] Not including main stem depletions.

[3] Not reported separately.

[4] Net exports are not included.

Source: (*23*).

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[46] This statement applies to the whole region, although data for basins other than the Colorado are not presented here.

were to operate at full capacity during periods of extreme low flow. Such possibilities, although remote, could doubtless affect the locations of future coal-processing facilities.

The Gulf Region. The more serious water resource problems in the Gulf Region have little to do with coal mining because it is such a small part of the regional economy. In AR-2 and AL-2, no coal is currently produced and none is expected to be produced in the future. The coal now being mined in Texas, as well as that planned for future mines, is to be used in mine-mouth electric power plants, which use large amounts of cooling water. Several proposed new generating plants are expected to use coal from Wyoming and Montana. Only 3 of the 34 projected coal-fired plants would be located in a water-deficit area (the Lower Canadian subregion), but they would obtain their coal from another region (*16*).

While supplies of water in the Gulf Region seem ample for future development, local conditions may limit supplies. Thus, site-specific data must be used in planning water needs for any given plant or even for a particular CPA.

The Pacific Region. Plans for expanding coal production in the Pacific Region are limited, so the problems relating to water tend to be minimal. Alaska has large water resources, and available supplies far exceed foreseeable demands (*124*). Because of the severe climate, however, many rivers flow little or not at all in winter; hence, storage of the full winter supply is sometimes needed. The areas involved in coal development represent fairly small portions of the State, and the water requirements for energy development are only a small part of the water resources (*16*).

In Washington west of the Cascades, available water resources could easily meet the needs for evaporative cooling of thermogenerators in the foreseeable future. Coal production would increase water consumption negligibly (*124*). General conclusions as to the nature and severity of water problems may not be valid for any specific coal development site, because conditions vary from one site to another.

Groundwater

In areas where surface water supplies are scarce, in quantity or availability, groundwater may be a possible alternate source. However, it is difficult to generalize as to where it may be found in quantities sufficient to encourage coal development because aquifers are out of sight and only by drilling a number of wells can their extent and probable yield be established. Thus dependable data on groundwater vary tremendously from one area to another, largely because the extent of drilling varies. The reliability of an aquifer as a source of water depends on its depth, thickness, rate of recharge, and quality. Some aquifers are being pumped at rates which appear in excess of the rate of recharge; this practice is known as "water mining."

The Tongue-Powder River Basin in Wyoming, where surface waters are unusually scarce, is an area where coal developers have considered groundwater as a possible source. Interest has focused on a geological formation called the Madison Group which underlies many of the CPA's in the Northern Great Plains. This formation is a potential source of extensive supplies of groundwater, but the aquifer is deep. It ranges from 4,000 to 5,000 feet deep in parts of eastern Montana to more than 10,000 feet along the eastern slopes of the Big Horn Mountains (*56*). The Madison Group is probably the only likely source of groundwater for coal development in the Northern Great Plains, although its great depth may limit potential usefulness.

It is generally believed that additional development of groundwater will result in water mining in the Rocky Mountain Region. Estimates of availability are not plentiful, but one source indicates that the upper bounds of recoverable ground water are as follows (*23*):

Basin	maf
Upper Colorado	82,940
Lower Colorado	473,000
Sevier Lake Subregion	21,700
Total	577,640

These figures suggest that a huge amount of water is available, but the quantities shown are spread over a four-State area; they represent an inventory of the total stock, not the amount that could be recovered or used in any given time period. The geographical dispersion of groundwater stocks makes site-specific investigations mandatory for any proposed new coal development facility.

In the Interior, Eastern, and Gulf Regions, some groundwater is available nearly everywhere, as all three lie in "water rich" areas, where surface water is also plentiful. Some localities, however, may be deficient in water, so planners must consider its availability when choosing a plant site.

Water Quality

In most areas where coal development is likely, water-quality issues are not whether the available supplies are of the right quality for coal development but whether development will adversely affect water quality for other uses. Water quality can be affected by pollution from two principal sources. The first is pollution from the mining operation, primarily acid-mine drainage. In the Eastern and Interior Regions, sulfur compounds exposed by the mining process may react with surface or ground water to form acids, which then drain from the mine and pollute the streams below. Acid drainage may occur either in underground mines or in strip mines. It may originate in the mine itself, or as a leachate from the spoil banks of surface mines or the "gob" piles from underground mines. Acid mine drainage problems can occur anywhere, although current laws require that mining companies take appropriate measures to insure against damage to water supplies from any phase of the mining activity (*77*).

The second source of pollution is from coal processing plants, mainly thermogenerators. Cooling water passed through such plants usually absorbs large quantities of heat. If the heated water is discharged directly into a stream, it constitutes thermal pollution, which in turn may cause drastic changes in the aquatic life downstream from the point of discharge. Laws controlling such pollution are strict, so plans for energy conversion plants must take into account the technology required to avoid pollution (thermal or otherwise) of the natural waters below the plants. Again, the measures required are specific to the site, so that we can offer only a generalized statement of the problem here.

Human Resources

Most areas of expanding coal mining are far from large cities, have a low population base and a relatively small work force. Thus, the socioeconomic impact of new coal development on these areas will probably be much stronger than in areas where mining is already well established.

Population Trends

Although the U.S. population generally has been increasing since colonial times, the rate of growth has been far from uniform geographically, a fact of particular interest for this study. The U.S. population increased 18.2 percent between 1950 and 1960, 13.3 percent between 1960 and 1970, and 4.8 percent between 1970 and 1975 (table 29). In 1950-60 and 1960-70, the increase was much larger in metropolitan (metro) locations than in nonmetropolitan (nonmetro) areas.[47] The trend in nonmetro population was characterized by a substantial outmigration in the fifties and a moderate outmigration in the sixties. In the 1970-75 period, the trend was reversed, resulting in a net inmigration. During this 5-year period, the nonmetro population grew at a faster rate than the metro population.

There are substantial differences in growth patterns among regions. The Rocky Mountain Region has the largest, most persistent growth rate; the population almost tripled in the 35 years from 1940 to 1975. Natural increase and inmigration contributed about equally to the growth. The Pacific Region also grew faster than the U.S. average in the fifties and sixties, but not as much in the 5-year period ending in 1975. Each of the remaining regions experienced a net outmigration in the decades of the fifties and sixties. Natural increase offset the outmigration, resulting in a moderate gain.

Regional averages and totals tend to conceal some important intraregional variations, particularly in the Rocky Mountain Region where the population gain in one CPA, CO-7, was greater than in all the others combined. The population in CO-7 grew from 343,000 to 1,297,000 in the 25 years from 1950 to 1975, an increase of 278 percent (app. table 10). The aggregate growth rate for all the other CPA's in the region was only 51 percent for the same period. CO-7 includes the three counties surrounding the city and county of Denver (but not Denver itself) and has two-thirds of the people living in the region. Most of the growth in CO-7 is due to the rapid expansion of the Denver metropolitan area, plus substantial growth in Colorado Springs, Greeley, Fort Collins, and other cities in the Front Range area just east of the main mountain ranges of Colorado. Some other CPA's in the region, AZ-1 and NM-2 for example, had large percentage growth rates in both the 1960-70 and 1970-75 periods, but the base from which they started was small.

In the Interior Region, AR-1, located mostly in the Ozark Mountains area, had the fastest growth rate in the 1960-75 period. In the Eastern Region, several CPA's decreased in population in both decades, 1950-60 and 1960-70. The largest percentage declines were in KY-4, KY-5, WV-4, and WV-6. In 1970-75, each of these CPA's increased moderately in population, as did most others in the region. In the Gulf Region, the largest population growth occurred in TX-1, especially in Bexar County where San Antonio is located. The dominant growth area in the Pacific Region was in the Seattle metro area. In the 15 years from 1960 to 1975, 24 CPA's declined in population; most of these were in the nonmetro areas of the Northern Great Plains and Eastern Regions.

The CPA's are predominantly nonmetro; in the aggregate they consist of 516 counties, of which 425 (or about 80 percent) are nonmetro (table 30). There are no metro counties in the Northern Great Plains. The Rocky Mountain Region has six metro counties, all of them in CO-7, a CPA dominated by the Denver metro area. The Interior Region has 159 nonmetro counties out of 200, although 52 percent of the people live in metro counties. Eight of the 24 Interior CPA's have no metro counties, and there are but two large metro areas (over 0.5 million population) in the CPA's of the region–Kansas City and Tulsa. One of the counties in IL-2 is part of the Chicago metro area, and two counties in IL-3 are part of the St. Louis metro area, but the central metro city of each is outside the boundaries of the CPA.

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[47] As used here, the term "metro" refers to counties which are a part of a Standard Metropolitan Statistical Area (SMSA), as reported by the U.S. Census in 1975 (*86*).

In the Eastern Region, 10 CPA's have no metro counties and 12 CPA's have some metro and some nonmetro counties. About 80 percent of the counties in the region are nonmetro. The principal metro areas in the region are Pittsburgh, PA, Birmingham, AL, and Canton, OH. WV-1 is unique as it is the only CPA nationwide that consists entirely of metro counties, the principal metro city being Wheeling, WV. The principal metro centers in the Gulf Region are San Antonio, as noted above, and Little Rock, AR. Seattle and Tacoma are the main metro centers in the Pacific Region.

Most of the Nation's coal is produced in nonmetro areas. All the coal mined in the three western regions–Northern Great Plains, Rocky Mountain, and Pacific–comes from CPA's with no metro counties. A substantial part of the coal in the Interior and Eastern Regions is mined in CPA's which are entirely nonmetro CPA's (table 31). A major portion of the remaining coal, 189 million tons, is produced in CPA's where between 34 and 66 percent of the population is metro. There are 16 counties with more than 10 million tons of coal production, and all but 2 of these are nonmetro (table 32). Belmont County, OH, eighth in coal production, is classified as metro because it is part of the Wheeling, WV, SMSA. Washington County, PA, tenth in coal production, is part of the Pittsburgh SMSA. None of the six leading coal counties is adjacent to any metropolitan center. Large-scale coal pro-

Table 29–Population trends in Coal Production Regions, 1940-75

Area	Population					Change, 1950-60		
	1940	1950	1960	1970	1975	Total	Natural	Net migration
	Thousands					*Percent*		
U.S. total	132,166	151,699	179,323	203,213	213,054	18.2	16.7	1.5
Metro	80,386	100,081	126,455	147,996	154,138	26.4	17.4	8.9
Nonmetro	51,780	51,618	52,868	55,217	58,916	2.4	15.4	−13.0
Regions:[1]								
Northern Great Plains	407	413	430	424	453	4.3	20.3	−15.9
Rocky Mountain	665	770	1,163	1,576	1,940	51.1	26.9	24.2
Interior	6,333	6,475	6,876	7,355	7,594	6.2	12.1	− 5.9
Eastern	9,699	10,182	10,294	10,164	10,419	1.1	14.7	−13.6
Gulf	1,732	1,837	2,001	2,254	2,445	8.9	18.8	− 9.8
Pacific	na	1,218	1,508	1,878	1,909	23.8	16.0	7.8

Area	Change, 1960-70			Change, 1970-75		
	Total	Natural	Net migration	Total	Natural	Net migration
	Percent					
U.S. total	13.3	11.6	1.7	4.8	3.6	1.2
Metro	17.0	12.3	4.7	4.2	3.8	.4
Nonmetro	4.4	10.1	− 5.6	6.7	3.3	3.4
Regions:[1]						
Northern Great Plains	−1.6	12.9	−14.5	6.9	4.6	2.3
Rocky Mountain	35.5	19.2	16.3	23.1	7.2	15.9
Interior	7.0	7.7	− .7	3.2	2.5	.7
Eastern	−1.3	8.1	− 9.4	2.5	2.6	.1
Gulf	12.6	12.8	− .2	8.5	4.9	3.6
Pacific	24.5	12.1	12.4	1.6	3.4	−1.8

na = Not available.

[1] Data represent the sums of the Coal Production Areas (CPA's) within each region (see app. table 2).

Sources: (*86* and *87*).

Table 30–Distribution of population, metro and nonmetro, 1975[1]

Coal Production Region	Counties[2]			Population[3]			
	Metro	Nonmetro	Total	Metro	Nonmetro	Total	Percentage metro
	Number			*Thousands*			*Percent*
Northern Great Plains	0	47	47	0	453	453	0
Rocky Mountain	6	35	41	1,292	648	1,940	67
Interior	41	159	200	3,925	3,669	7,594	52
Eastern	35	136	171	5,788	4,631	10,419	56
Gulf	7	44	51	1,537	909	2,445	63
Pacific	2	4	6	1,563	346	1,909	82
Total/Average	91	425	516	14,105	10,655	24,760	57

[1] Metro counties are those which constitute any part of a Standard Metropolitan Statistical Area (SMSA).
[2] Excludes Alaska.
[3] Includes Alaska.

Source: *(87)*.

Table 31–Coal production in metro and nometro Coal Production Areas (CPA's), 1977

Region	Percentage of population that is metro[1]			All metro CPA's	Nonmetro	Total	Percentage of total
	67-100	34-66	1-33				
	Million tons						*Percent*
Northern Great Plains	0	0	0	0	83.5	83.5	12.1
Rocky Mountain	.1	0	0	.1	43.5	43.6	6.3
Interior	30.4	90.2	1.6	122.3	25.1	147.3	21.2
Eastern	84.8	99.2	50.7	234.7	161.3	395.9	57.1
Gulf	16.8	0	0	16.8	0	16.8	2.4
Pacific	*	0	0	*	5.7	5.7	.8
Total	132.1	189.4	52.3	373.9	319.1	693.0	100.0
				Percent			
	19.1	27.3	7.5	54.0	46.0	100.0	N.A.

*Less than 50,000 tons.
N.A. = not applicable.
[1] Percentage of people in the CPA who lived in metro counties in 1975.

Source: *(87)* and appendix table 3.

duction is essentially a nonmetro activity. Coal mining does not depend on a large metropolitan center for its supply of labor or market outlets; neither does it necessarily draw together a large population.[48]

Employment

Total wage and salary employment in the CPR's in 1975 was 8.8 million workers, of whom 40 percent were in the Eastern Region and 31 percent were in the Interior Region (table 33).[49] The Northern Great Plains had the smallest number of employed workers. In the Eastern Region, the manufacturing industry has the most employees–26 percent of the total–with trade second, and services third. Coal mining accounted for only 4.7 percent of the total employees. In the Interior Region, manufacturing was the most important employing industry with 22.7 percent; government was next, and trades was third. Only 1.1 percent of employment was in coal mining. In each of the other four regions, government employed the most people, trades was second, and services third. Coal mining was near the bottom in each region, and for all the CPA's combined it accounted for only 2.36 percent of all employed persons.

Table 32–Leading coal-producing counties, 1977

Rank	County	Coal Production Area	Production
			Million tons
1	Pike	KY-4	18.1
2	Campbell	WY-2	17.4
3	Muhlenburg	KY-1	17.2
4	Buchanan	VA-1	16.5
5	Big Horn	MT-4	14.8
6	Carbon	WY-3	12.1
7	Rosebud	MT-4	12.1
8	Belmont	OH-1	11.8
9	Wise	VA-1	11.3
10	Washington	PA-1	11.2
11	Navajo	AZ-1	11.1
12	Indiana	PA-2	10.4
13	Monongalia	WV-2	10.4
14	Hopkins	KY-1	10.4
15	Ohio	KY-1	10.3
16	Warrick	IN-3	10.1

Note: *Underlining* indicates metro counties; Belmont county is part of the Wheeling, WV, Standard Metropolitan Statistical Area (SMSA), and Washington county is part of the Pittsburgh, PA, SMSA.

Source: (*103*).

In the 5 years, 1970-75, wage and salary employment rose 10 percent in the six regions; the number increased from 8.0 million to 8.8 million (table 34). In percentage terms the largest increase was in the Rocky Mountain Region, nearly 40 percent, and the smallest was in the Eastern Region, only 6 percent. In the same period, coal mining employment increased from about 138,000 workers to 209,000 workers, an average annual growth rate of about 10 percent. Although the Pacific and Northern Great Plains Regions showed the largest percentage increase, the Eastern region grew most in numbers of workers. The fact that coal mining employment in the Eastern Region increased 48 percent while coal production decreased 5.1 percent during the same period suggests a substantial decrease in production per coal mining employee.

Selected Socioeconomic Characteristics

Since most CPA's are nonmetro, it follows that they should generally have the socioeconomic characteristics of other nonmetro areas. Pertinent statistics bear this out. Family income and individual earnings in five of the six CPR's are substantially below the average for all metro areas in the United States, but above or near the level of the nonmetro average (table 35). The exception is the Pacific Region, which includes Alaska where wages and prices have been relatively high since statehood. A low rate of poverty is another indicator of economic well being. Five of the CPR's have more poverty than the U.S. metro areas, but less than the average of nonmetro areas. The exception is the Pacific Region. The CPR's generally have lower labor force participation rates than do metro areas. As indicated by median age, the people of the Interior and Eastern Regions are older than those in the rest of the United States. The people of Eastern and Gulf Regions have less schooling (that is, lower median school years and a lower high school completion rate) than the rest of the U.S. population. Fertility rates and dependency rates are generally higher than the national average. The mobility rate in the Eastern Region is much lower than the national average, whereas in the Pacific Region it is much higher.[50]

Although most of the area of the CPA's is nonmetro, somewhat more than half the people live in metro counties. Migration patterns, as well as other socioeconomic characteristics, are roughly similar to those observed in nonmetro areas. While coal mining is a major occupation in some local areas, it is a relatively small part of the total employment pattern from a regional and national perspective. In a few CPA's, coal mining is a relatively new and rapidly expanding activity; most such areas have a low population base and a relatively small work force. The socioeconomic impact of coal development on such areas is expected to be much more severe than in CPA's where mining activity is already well established and where the expansion rate is expected to be more gradual (*48*).

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[48] For a detailed analysis of the general characteristics of metro and nonmetro areas, see (*30*).

[49] Wage and salary employment data were used in place of Census data because the latter are not available by county for any year since 1970.

[50] For a detailed analysis of the socioeconomic characteristics of the people of the Northern Great Plains, see (*50*).

Table 33–Employment by industry groups, by Coal Production Region, 1975

Industry	Northern Great Plains	Rocky Mountain	Interior	Eastern	Gulf	Pacific	Total or average
				Percent			
Coal mining	1.43	0.93	1.13	4.72	0.05	0.08	2.36
Other mining	5.52	1.76	.89	.41	1.02	.22	.80
Government	26.55	29.77	21.14	16.59	28.38	24.84	21.12
Manufacturing	4.59	12.16	22.72	26.38	16.10	16.95	21.86
Contract construction	8.98	6.49	4.45	4.30	5.10	4.91	4.74
Transportation	6.94	3.98	5.78	6.12	4.73	6.23	5.74
Trades	20.85	21.22	20.72	19.33	19.69	21.12	20.13
Finance, insurance, and real estate	2.80	3.82	4.29	3.90	4.73	6.00	4.27
Services	16.90	17.87	16.71	17.29	18.71	18.36	17.39
Agriculture, forestry, and fisheries	5.43	2.01	2.16	.96	1.50	1.29	1.58
Total	100	100	100	100	100	100	100
				Thousands			
Total employment	174	647	2,716	3,578	901	828	8,844

Totals may not add to 100 because of rounding.

Source: (*88*).

Table 34–Changes in employment in coal mining and in all industries, 1970 and 1975

Region	Employment in all industries			Coal mining employment		
	1970	1975	Increase	1970	1975	Increase
	Number		*Percent*	*Number*		*Percent*
Northern Great Plains	136,448	173,997	27.5	772	2,483	221.6
Rocky Mountain	462,806	646,508	39.7	3,283	6,012	83.1
Interior	2,484,507	2,716,245	9.3	20,196	30,668	51.9
Eastern	3,365,073	3,577,875	6.3	113,781	168,898	48.4
Gulf	823,902	901,178	9.4	0	440	–
Pacific	759,905	827,844	8.9	159	625	293.1
Total or average	8,032,641	8,843,647	10.1	138,191	209,126	51.3

– = Not applicable.

Source: (*88*).

Table 35–Selected socioeconomic characteristics, 1969 and 1970

Area	1969				1970								
	Median family income	Median earnings		Poverty incidence[1]	Labor force participation rate[1]		Median age	Median school years	Fertility rate[1]	High school completion rate[1]	Dependency rate[1]	Mobility rate[1]	Husband and wife families[1]
		Male	Female		Male	Female							
	Dollars			Percent			Number			Percent			
United States	9,590	7,515	3,413	13.7	72.9	39.6	28.1	12.1	2,956	52.3	79.5	40.4	86.0
Metropolitan	10,406	8,008	3,660	11.3	74.4	40.8	28.0	12.2	2,859	55.1	77.1	40.8	85.5
Nonmetropolitan	7,615	6,128	2,742	20.2	68.8	36.1	28.3	11.2	3,245	45.0	86.5	39.1	87.2
Northern Great Plains	8,068	6,353	2,234	15.6	72.8	34.7	26.5	12.1	3,639	51.8	92.3	40.5	89.9
Rocky Mountain	9,601	7,603	3,018	14.7	74.5	38.8	24.3	12.4	3,182	64.3	82.4	40.4	89.2
Interior	[2]8,527	[2]6,974	[2]3,008	13.8	71.2	37.6	29.6	12.0	3,053	51.5	83.3	43.6	88.3
Eastern	[2]8,172	[2]7,088	[2]3,034	17.5	67.3	31.5	29.8	11.4	2,957	45.8	80.3	33.8	86.0
Gulf	7,317	5,798	2,808	23.7	69.2	36.4	26.9	11.1	3,179	43.9	83.7	42.9	84.8
Pacific	11,154	8,769	3,953	8.8	76.4	40.8	27.0	12.4	2,960	66.3	72.6	48.4	88.8

[1] For method of calculation, see (*50*).

[2] Mean of the area medians.

Source: (*86*).

Implications

In this report, we have described the resources of coal, agriculture, water, and people, and we have described the relationship between these resources and coal development. However, the quality of some of the estimated data can be improved. Better data should then lead to improved results from the national analytical model.

First, available estimates of land required for permanent mine facilities vary significantly from one area to another and from one source reference to another, partly because of differences among definitions of "fixed" land requirements. We need a detailed survey of existing mines and of planned new mines to ascertain the acreage actually used for shops, offices, parking lots, coal-handling and cleaning facilities, onsite coal storage, haul roads, railroad loops, or sidings, and similar fixed facilities.

Second, in calculating the value of agricultural production at risk from coal development, we used data from the 1974 Census of Agriculture, the most recent available. However, results from the 1978 Census of Agriculture will soon be published; our estimates could then be updated.

Third, we established the CPA's based on the latest available nationwide compilations of coal reserves. More recent data on coal reserves are just now becoming available for specific areas. More complete data on coal resources and reserves would yield more accurate estimates of reserve totals.

Last, additional problems need study—including studies of the effect of coal-produced pollutants, such as "acid rain," on agricultural production; site-specific studies of land requirements and changes in patterns of ownership and farm operation in areas where new mines are contemplated; and more detailed studies of the impact of coal development on water supplies, both surface and underground. Such studies could help to solve problems faced by those in industry and government who must plan for coal development.

Bibliography

(1) Alaska State Division of Forest, Land, and Water Management. *Land for Alaskans.* December 1978.

(2) Anderson, Donald. *Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast.* Prepared by the Department of Mining, Metallurgical, and Ceramic Engineering, University of Washington, for the U.S. Bureau of Mines. 1977.

(3) Averitt, Paul. *Coal Resources of the United States, January 1, 1974.* Bulletin 1412. U.S. Department of the Interior, Geological Survey, 1975.

(4) ____________. *Stripping–Coal Resources of the United States–January 1, 1970.* Bulletin 1332. U.S. Department of the Interior, Geological Survey, 1970.

(5) Barnes, Farrell F. *Coal Resources of Alaska.* Bulletin 1242-B. U.S. Department of the Interior, Geological Survey, 1967.

(6) Beilkman, H. M., and H. D. Gower. "Coal," *Mineral and Water Resources of Washington.* 89th Congress, 2nd Session, Committee on Interior and Insular Affairs, Committee Print, 1967, pp. 276-286.

(7) Benson, David C., and Frank J. Doyle. *Projects to Expand Fuel Sources in Eastern United States* (as of July 1977). Information Circular 8765. U.S. Department of Interior, Bureau of Mines, 1978.

(8) Berkshire, L. H., and E. L. Hemingway. *Basic Estimated Capital Investment and Operating Costs for Three Coal Strip Mines.* RE/EES-78/1. U.S. Department of Energy, Engineering Economics and Standards Section, November 1977.

(9) Brown, Donald M. *Lignite Resources of South Dakota.* Geological Survey Circular 81. U.S. Department of the Interior, 1952.

(10) Carter, Ralph P., and Roy E. Cameron. *Land Reclamation Program–Annual Report, July 1975-July 1976.* Argonne National Laboratory, December 1976.

(11) Cavallaro, J. A., M. T. Johnston, and A. W. Deurbrouck. *Sulfur Reduction Potential of U.S. Coals: A Revised Report of Investigations.* Joint EPA-Bureau of Mines Report, EPA 600/2-76-091, Bureau of Mines RI 8118, April 1976.

(12) Charles River Associates, Inc. *The Economic Impact of Public Policy on the Appalachian Coal Industry and the Regional Economy.* Vol. I and II. January 1973.

(13) Corsentino, John S. *Projects to Expand Fuel Sources in Western States (as of May 1976).* Information Circular 8719. U.S. Department of the Interior, Bureau of Mines, 1976.

(14) Culbertson, William C. *Geology and Coal Resources of the Coal Bearing Rocks of Alabama.* Bulletin 1182-B. U.S. Department of the Interior, Geological Survey, 1964.

(15) Dick, James. *Staff Report on Mineral Leasing on Indian Lands.* Federal Trade Commission, Bureau of Competition, Washington, D.C., October 1975.

(16) Dobson, Jerome E., and others. *A Nationwide Assessment of Water Quantity Impacts on the National Energy Plan,* Vol. I: *Summary and Conclusions.* Sponsored by U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, Tenn., December 1977.

(17) Doyle, John C., Jr. *State Strip Mining Laws: An Inventory and Analysis of Key Statutory Provisions in 28 Coal Producing States.* Environmental Policy Institute, Washington, D.C., March 1977.

(18) Dupree, W. G., and J. S. Corsentino. *United States Energy through the Year 2000* (revised). U.S. Department of the Interior, Bureau of Mines, December 1975.

(19) Energy and Environmental Analysis, Inc. *Benefit-Cost Analysis of Laws and Regulations Affecting Coal: Case Studies on Reclamation, Air Pollution, and Health and Safety Laws and Regulations.* Prepared for Office of Mineral Policy and Research Analysis, U.S. Department of the Interior, July 1977.

(20) Environmental Research and Technology, Inc. *An Overview of Federal Coal Mine Regulations: Requirements of the Federal Surface Mining and Control Reclamation Act of 1977,* September 1979.

(21) Evans, R. J., and J. R. Bitler. *Coal Surface Mining Reclamation Costs—Appalachian and Midwestern Coal Supply Districts.* Information Circular 8695. U.S. Department of the Interior, Bureau of Mines, 1976.

(22) Grandt, Alten F. "Mined Land Reclamation in the Interior Coal Province," *Journal of Soil and Water Conservation,* Vol. 22, No. 2, March-April 1978, pp. 62-68.

(23) Gray, S. Lee, Edward W. Sparling, and Norman K. Whittlesey. *Water for Energy Development.* NRED 80-3. U.S. Department of Agriculture, ESCS Staff Report, December 1979.

(24) Green, John W. *Western Energy: The Interregional Coal Analysis Model.* TB-1627. U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service, August 1980.

(25) Grim, E. C., and R. D. Hill. *Environmental Protection in Surface Mining of Coal.* Environmental Protection Agency, Report 670/2-74-093, October 1974.

(26) Hamilton, P. A., D. H. White, Jr., and J. K. Matson. *The Reserve Base of U.S. Coals by Sulfur Content,* Part 2: *The Western States.* Information Circular 8693. U.S. Department of the Interior, Bureau of Mines, 1975.

(27) Harris, Marshall. *Origin of the Land Tenure System in the United States.* Iowa State University Press, Ames, Iowa, 1953.

(28) Hennagin, David B. "Appendix: Cook Inlet Coal: Economics of Mining and Marine Slurry Transport." Prepared by the University of Washington, Department of Mining, Metallurgical, and Ceramic Engineering for the U.S. Bureau of Mines, January 1978.

(29) Hill, Ronald D. "Control and Prevention of Mine Drainage." Paper presented at Battelle Conference, Columbus, Ohio, November 1972.

(30) Hines, Fred K., David L. Brown, and John M. Zimmer. *Social and Economic Characteristics of the Population in Metro and Nonmetro Counties, 1970.* AER-272. U.S. Department of Agriculture, Economic Research Service, March 1975.

(31) Hoffman-Munter Corporation. Correspondence with Elmer C. Holt, Jr., Vice-President. Silver Spring, Md., August 17, 1979.

(32) Holmberg, George V. "Vegetation Establishment on Abandoned Coal Mined Land." Paper presented at the 1978 Winter Meeting, American Society of Agricultural Engineers, Chicago, Ill., December 18-20, 1978.

(33) ICF, Inc. *Energy and Economic Impacts of H.R. 13950* (Surface Mining Control and Reclamation Act of 1976). Final Report (Appendices). Report submitted to the Council on Environmental Quality and Environmental Protection Agency, September 1977.

(34) Illinois Department of Mines and Minerals. *1976 Annual Report.* Springfield, Ill., 1976.

(35) Illinois South Project, Inc. *A Handbook on Coal Leasing and Land Owners Organization.* Carterville, Ill., Winter 1976.

(36) Imhoff, E. A., Thomas L. Fritz, and J. R. LaFevers. *A Guide to State Programs for the Reclamation of Surface Mine Areas.* Circular 732. U.S. Department of the Interior, Geological Survey, 1976.

(37) Johnson, Wilton, and George C. Miller. *Abandoned Coal-Mined Lands: Nature, Extent, and Cost of Reclamation.* U.S. Department of the Interior, Bureau of Mines, 1979.

(38) Kaiser Engineers, Inc. *Technical and Economic Feasibility Surface Mining Coal Deposits North Slope of Alaska.* Prepared for the U.S. Bureau of Mines, August 1977.

(39) Katell, Sidney, E. L. Hemingway, and L. H. Berkshire. *Basic Estimated Capital Investment and Operating Costs of Coal Strip Mines.* Information Circular 8703 (revision of Information Circular 8661). U.S. Department of the Interior, Bureau of Mines, 1976.

(40) Lawrence, Anthony G. *The Causes and Consequences of the Changing Pattern of Coal Mine Ownership: An A Priori Analysis.* University of Kentucky, Lexington, Ky., September 1975.

(41) Leathers, K. L. *Costs of Strip Mine Reclamation in the West.* RDRR-19. U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service, February 1980.

(42) Leistritz, F. Larry, and Stanley W. Voelker. "Coal Resource Ownership: Patterns, Problems, and Suggested Solutions," *Natural Resources Journal,* Vol. 15, October 1975, pp. 643-662.

(43) McGraw-Hill, Inc. *Coal Week.* Various issues.

(44) McGraw-Hill Publications. *Keystone Coal Industry Manual.* Various years (annual).

(45) Miller, Tom D. "Who Owns West Virginia?" Reprinted from the *Herald Dispatch,* Huntington, W.Va., December 1974.

(46) Missouri Basin Interagency Committee. *Missouri River Basin Comprehensive Framework Study.* June 1969.

(47) Missouri River Basin Commission. *Yellowstone River Basin and Adjacent Coal Areas Level B. Study.* Omaha, Nebr., November 1978.

(48) Murdock, Steve H., and F. Larry Leistritz. *Energy Development in the Western United States.* New York: Praeger Publishers, 1979.

(49) Mutschler, P. H., R. J. Evans, and G. M. Larwood. *Comparative Transportation Costs of Supplying Low Sulfur Fuels to Midwestern and Eastern Energy Markets.* Information Circular 8614. U.S. Department of the Interior, Bureau of Mines, 1973.

(50) Myers, Paul R., Fred K. Hines, and Jeff. V. Conopask. *A Socioeconomic Profile of the Northern Great Plains Coal Region.* AER-400. U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service, March 1978.

(51) National Academy of Engineering. *U.S. Energy Prospects: An Engineering Viewpoint.* Report prepared by the Academy's Task Force on Energy, 1974.

(52) National Academy of Sciences. *Rehabilitation Potential of Western Coal Lands.* Report to the Energy Policy Project of the Ford Foundation. Cambridge, Mass.: Ballinger Publishing Co., 1974.

(53) National Coal Association. *Steam Electric Plant Factors.* 1976.

(54) Nehring, Richard, Benjamin Zycher, and Joseph Wharton. *Coal Development and Government Regulation in the Northern Great Plains.* Report R-1981-NSF/RC. Santa Monica, Calif.: The Rand Corporation, August 1976.

(55) Northern Great Plains Resource Program. *Effects of Coal Development in the Northern Great Plains.* Summary Report. Denver and Washington, D.C., April 1975.

(56) ____________. *Water Work Group Report.* December 1974.

(57) Noyes Data Corporation. *Coal Resources, Characteristics, and Ownership in the U.S.* Park Ridge, N.J., 1978.

(58) Ostendorf, David L., and Joan E. Gibson. *Illinois Land–The Emerging Conflict Over the Use of Land, Agricultural Production and Coal Development.* The Illinois South Project, Inc., Carterville, Ill., Summer 1976.

(59) Pacific Southwest Interagency Committee. *Lower Colorado Region Comprehensive Framework Study.* Appendix V: Water Resources. Water Resources Council, June 1971.

(60) Packer, P. E. *Rehabilitation Potentials and Limitations of Surface-Mined Land in the Northern Great Plains.* General Technical Report INT-14. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah, 1974.

(61) Page, Walter P. "Competition and Concentration in Appalachian Coal Production, 1960 to 1975," *Policy Analysis and Information Systems,* Vol. 1, June 1979, pp. 141-160.

(62) Paone, J., J. L. Morning, and L. Georgetti. *Land Utilization and Reclamation in the Mining Industry, 1930-1971.* Information Circular 8642. U.S. Department of the Interior, Bureau of Mines, 1974.

(63) Persse, Franklin H., David W. Lockard, and Alec A. Lindquist. *Coal Surface Mining Reclamation Costs in the Western States.* Information Circular 8737. U.S. Department of the Interior, Bureau of Mines, 1977.

(64) Plass, William T. "Reclamation of Coal-Mined Land in Appalachia," *Journal of Soil and Water Conservation,* Vol. 33, No. 2, March-April 1978, pp. 56-61.

(65) Price, Don, and Ted Arrow. *Summary Appraisals of the Nation's Ground Water Resources–Upper Colorado Region.* Professional Paper 813-C. U.S. Geological Survey, 1974.

(66) Radian Corporation. *An Environmental Overview of Future Texas Lignite Development.* DCN No. 77-200-187-06-06. U.S. Environmental Protection Agency, January 1978.

(67) Rick, Charles H., Jr. *Projects to Expand Energy Sources in the Western States* (as of August 1977). Information Circular 8772. U.S. Department of the Interior, Bureau of Mines, 1978.

(68) Rieber, Michael. "Low Sulfur Coal: A Revision of Reserve and Supply Estimates," *Journal of Environmental Economics and Management,* Vol. 2, 1975, pp. 40-59.

(69) Schaub, John R., Joseph R. Barse, and Lloyd D. Bender. "Research Program on the Economic and Social Consequences of Coal and Oil Shale Development," *Health, Environmental Effects, and Control Technology of Energy Use.* Environmental Protection Agency, Report 600/7-76-002. Proceedings of February 1976 conference.

(70) Selvig, W. A., and others. *American Lignites: Geological Occurrence, Petrographic Composition, and Extractable Waxes.* Bulletin 482. U.S. Department of the Interior, Bureau of Mines, 1950.

(71) Smith, Albert E., Thomas D. Walsko, and Richard R. Cirello. *Coal Supply and Air Quality Limitations on Fossil-Fueled Energy Centers.* Argonne National Laboratory, August 1976.

(72) Smith, J. B. *Strippable Coal Reserves of Wyoming: Location, Tonnage, and Characteristics of Coal and Overburden.* Information Circular 8538. U.S. Department of the Interior, Bureau of Mines, 1972.

(73) Strovel, Raymond B., and others. *Mineral Resources and Industries of Arkansas.* Bulletin 645. U.S. Department of the Interior, Bureau of Mines, 1969.

(74) Thomson, R. D., and H. F. York. *The Reserve Base of U.S. Coals by Sulfur Content.* Part 1: *The Eastern States.* Information Circular 8680. U.S. Department of the Interior, Bureau of Mines, 1975.

(75) Toenges, Albert L. *Reclamation of Stripped Coal Land.* Report of Investigations Number 3440. U.S. Bureau of Mines, Washington, D.C., February 1939.

(76) U.S. Congress. "Federal Coal Leasing Amendments Act." Public Law 94-377, August 4, 1976.

(77) ____________, "Surface Mining Control and Reclamation Act of 1977." Public Law 95-87, 95th Congress, 91 Stat. 445, August 3, 1977.

(78) ____________, House of Representatives, Committee on Interior and Insular Affairs. *Committee Report on the Federal Coal Leasing Amendments Act of 1975.* November 21, 1975.

(79) U.S. Department of Agriculture, Economics, Statistics, and Cooperatives Service. "Resources of the ____________ Region and Coal Development." ESCS working papers, one for each region as follows:
    Northern Great Plains–April 1977
    Rocky Mountain–April 1978
    Interior–August 1978
    Eastern–December 1978
    Gulf–June 1979
    Pacific–May 1979

(80) ____________, Forest Service. *Areas of National Forest and Other Lands Administered by the Forest Service as of June 30, 1974.* Washington, D.C.

(81) __________ *Land Areas of the National Forest System as of September 30, 1978.* File 1380 (5400). Washington, D.C., November 1978.

(82) __________, Soil Conservation Service. *The Status of Land Disturbed by Surface Mining in the United States: Basic Statistics by State and County, as of July 1, 1977.* SCS-TP-158. 1979.

(83) __________. *Plant Performance on Surface Coal Mine Spoil in the Eastern United States.* SCS-TP-155. April 1978.

(84) U.S. Department of Commerce, Bureau of the Census. *Census of Agriculture.* Vol. 1, 1974.

(85) __________. "General Housing Characteristics," *Census of Housing, 1970.*

(86) __________. *Census of Population.* 1940, 1950, 1960, and 1970.

(87) __________. *Current Population Reports.* Series P-25, various issues, and Series P-26.

(88) __________, Bureau of Economic Analysis. *Regional Economic Information System.* No date.

(89) U.S. Department of Energy. *Status of Coal Supply Contracts for New Electric Generating Units, 1977-1986.* First Annual Supplement. DOE/FERC-0004/1. May 1978.

(90) __________, Energy Information Administration. "Energy Data Reports," *Weekly Coal Reports.* Various issues.

(91) __________, Leasing Policy Development Office. *Federal Coal Leasing and 1985 and 1990 Regional Coal Production Forecasts.* June 1979.

(92) __________, Office of Coal Supply Development. *Western Coal Development Monitoring System.* April 1979.

(93) U.S. Department of the Interior, Bureau of Indian Affairs, Office of Trust Responsibilities. *Annual Report of Indian Lands as of September 30, 1977.* 1977.

(94) __________, Bureau of Land Management. *Annual Reports of BLM State Offices.* Various titles, 1978 and earlier years.

(95) __________. *Everything you always wanted to know about Land Status . . . but were afraid to ask.* Bureau of Land Management State Office, Anchorage, Alaska, 1978.

(96) __________. *Federal Coal Management Program.* Final Environmental Statement, April 1979.

(97) __________. *Known Recoverable Coal Resource Areas–Surface/Subsurface Ownership Patterns.* 1978.

(98) __________. *Public Land Statistics, 1976.* 1976.

(99) __________. *West Central North Dakota Regional Environmental Impact Study on Energy Development.* Draft, in cooperation with State of North Dakota, Bismarck, N. Dak., January 1978.

(100) __________, Bureau of Mines. *Cost Analysis of Model Mines for Strip Mining of Coal in the United States.* Information Circular 8535, 1972.

(101) __________. *Economic Engineering Analysis of U.S. Surface Coal Mines and Effective Reclamation.* Open File Report 74-75. 1975.

(102) __________. *Mineral Industry Surveys, Bituminous Coal and Lignite Distribution.* Various years.

(103) __________. *Mineral Industry Surveys, Coal–Bituminous and Lignite Production.* Various years.

(104) __________. *Mineral Industry Surveys, Effects of Air Quality Requirements on Coal Supplies,* May 1976.

(105) __________. *Mineral Yearbooks.* Various years since 1932.

(106) __________. *Strippable Reserves of Bituminous Coal and Lignite in the U.S.* Information Circular 8531. 1971.

(107) __________, Bureau of Reclamation and the State of Colorado. *Colorado State Water Plan, Phase I - Appraisal Report.* February 1974.

(108) __________, Bureau of Reclamation. *Projected Water Supply and Depletion, Upper Colorado River Basin.* August 1976.

(109) __________. *Quality of Water, 1975, Colorado River Basin.* Progress Report No. 7, 1975.

(110) ____________, Geological Survey. *1970 Water Resource Data for Montana, North Dakota, South Dakota, and Wyoming, Surface Water Records.* 1971.

(111) ____________, Office of Surface Mining Reclamation and Enforcement. *Permanent Regulatory Program of the Surface Mining Control and Reclamation Act of 1977.* Final regulatory analysis, OSM-RA-1. Washington, D.C., March 1979.

(112) ____________, Water for Energy Management Team. *Report on Water for Energy in the Northern Great Plains.* January 1975.

(113) U.S. Environmental Protection Agency. *Processes, Procedures, and Methods of Control Pollution from Mining Activities.* EPA-430/9-73-011. October 1973.

(114) U.S. Federal Energy Administration. *Trends in Power Plants Capacity: Inventory of Power Plants in the United States.* April 1976.

(115) ____________. *National Energy Outlook.* 1976.

(116) U.S. Federal Power Commission, Division of Power Surveys and Analysis. *Status of Coal Supply Contracts for New Electric Generating Units, 1976-1985.* Washington, D.C., 1977.

(117) U.S. Federal Register. "Abandoned Mine Land Reclamation Program Provisions," Vol. 43, No. 81, Part III, April 26, 1978.

(118) ____________. "Federal Coal Ownership in Eastern States," BLM Data by Counties, Vol. 44, No. 103, May 25, 1979, pp. 30590-92.

(119) ____________. "New Stationary Sources Performance Standards, Electric Utility Steam Generating Units," Vol. 44, No. 113, 40 CFR, Part 60, June 11, 1979.

(120) ____________. "Surface Coal Mining and Reclamation Enforcement Provisions–Proposed Rules for Permanent Regulatory Program," Vol. 43, No. 181, Part III, September 18, 1978.

(121) ____________. "Surface Mining Reclamation and Enforcement Provisions," Vol. 42, No. 239, Part II, Ch. VII, December 13, 1977.

(122) U.S. General Services Administration, Office of Administration. *Real Property Owned by the United States.* County Data, 1975. Summary Report, 1977.

(123) U.S. Water Resources Council. *Water for Energy Self-Sufficiency.* Washington, D.C., October 1974.

(124) ____________. *Water Requirements, Availabilities, Constraints, and Recommended Federal Actions.* Project Independence Blueprint, Prepared for U.S. Federal Energy Administration, Washington, D.C., November 1974.

(125) Watts, M. J. "Estimated Costs of Spoil Bank Reclamation Alternatives." Staff paper 75-24, Department of Economics, Montana State University, Bozeman, Mont., 1975.

(126) J. W. Wilson & Associates, Inc. *Report to Federal Trade Commission on the Structure of the Nation's Coal Industry.* Washington, D.C., April 1978.

(127) Young, Robert A., and George Stepko, Jr. *Ownership and Land Use Constraints Upon the Recoverability of Coals. A Methodology and Test Case.* West Virginia University, Morgantown, W. Va., 1976.

Appendix table 1--Counties included in Coal Production Areas

NORTHERN GREAT PLAINS REGION

MT-1
091 Sheridan

MT-2
021 Dawson
025 Fallon
083 Richland
085 Roosevelt
109 Wibaux

MT-3
055 McCone
079 Prairie

MT-4
003 Big Horn
033 Garfield
065 Musselshell
087 Rosebud
103 Treasure

MT-5
017 Custer
075 Powder River

ND-1
013 Burke
023 Divide
049 McHenry
053 McKenzie
055 McLean
061 Mountrail
101 Ward
105 Williams

ND-2
007 Billings
015 Burleigh
025 Dunn
033 Golden Valley
057 Mercer
059 Morton
065 Oliver

ND-3
001 Adams
011 Bowman
037 Grant
041 Hettinger
087 Slope
089 Stark

SD-1
031 Corson
041 Dewey
063 Harding
105 Perkins

WY-1
033 Sheridan

WY-2
005 Campbell
019 Johnson

WY-3
007 Carbon
009 Converse

WY-4
023 Lincoln
037 Sweetwater

ROCKY MOUNTAIN REGION

AZ-1
001 Apache
005 Coconino
017 Navajo

CO-1
081 Moffat
107 Routt

CO-2
057 Jackson

CO-3
043 Fremont
093 Park

CO-4
029 Delta
045 Garfield
051 Gunnison
077 Mesa
085 Montrose
091 Ouray
097 Pitkin
103 Rio Blanco

CO-5
007 Archuleta
067 LaPlata
083 Montezuma

CO-6
055 Huerfano
071 Las Animas

CO-7
001 Adams
005 Arapahoe
013 Boulder
039 Elbert
041 El Paso
059 Jefferson
123 Weld

NM-1
045 San Juan

NM-2
031 McKinley
043 Sandoval

NM-3
007 Colfax

NM-4
053 Socorro

UT-1
007 Carbon
015 Emery
041 Sevier

UT-2
017 Garfield
025 Kane
055 Wayne

UT-3
047 Uintah

INTERIOR REGION

AR-1
033 Crawford
047 Franklin
071 Johnson
083 Logan
115 Pope
127 Scott
131 Sebastian

IL-1
001 Adams
009 Brown
011 Bureau
057 Fulton
067 Hancock
073 Henry
095 Knox
109 McDonough
131 Mercer
143 Peoria
161 Rock Island
169 Schuyler
175 Stark
187 Warren

IL-2
063 Grundy
091 Kankakee
099 LaSalle
105 Livingston
113 McLean
123 Marshall
155 Putnam
179 Tazwell
197 Will
203 Woodford

IL-3
005 Bond
013 Calhoun
017 Cass
021 Christian
051 Fayette
061 Greene
083 Jersey
107 Logan
115 Macon
117 Macoupin
129 Menard
135 Montgomery
137 Morgan
139 Moultrie
167 Sangamon
171 Scott
173 Shelby

IL-4
023 Clark
029 Coles
035 Cumberland
041 Douglas
045 Edgar
183 Vermilion

Appendix table 1–Counties included in Coal Production Areas

INTERIOR REGION–Cont'd.

IL-5
027 Clinton
077 Jackson
119 Madison
133 Monroe
145 Perry
157 Randolph
163 St. Clair
189 Washington

IL-6
033 Crawford
047 Edwards
055 Franklin
059 Gallatin
065 Hamilton
081 Jefferson
101 Lawrence
121 Marion
165 Saline
185 Wabash
191 Wayne
193 White
199 Williamson

IN-1
045 Fountain
121 Parke
165 Vermillion

IN-2
021 Clay
119 Owen
153 Sullivan
167 Vigo

IN-3
027 Daviess
037 Dubois
051 Gibson
055 Greene
083 Knox
101 Martin
123 Perry
125 Pike
129 Posey
147 Spencer
163 Vanderburg
173 Warrick

IA-1
117 Lucas
123 Mahaska
125 Marion
135 Monroe
179 Wapello

IA-2
007 Appanoose
015 Boone
049 Dallas
051 Davis
053 Decatur
073 Greene
077 Guthrie
079 Hamilton
083 Hardin
087 Henry
099 Jasper
101 Jefferson
107 Keokuk
111 Lee
127 Marshall
153 Polk
163 Scott
169 Story
177 Van Buren
181 Warren
187 Webster

KS-1
005 Atchison
013 Brown
103 Leavenworth
131 Nemaha

KS-2
059 Franklin
139 Osage

KS-3
011 Bourbon
021 Cherokee
035 Cowley
037 Crawford
107 Linn

KY-1
031 Butler
047 Christian
055 Crittenden
059 Daviess
061 Edmonson
085 Grayson
091 Hancock
101 Henderson
107 Hopkins
149 McLean
177 Muhlenburg
183 Ohio
225 Union
233 Webster

MO-1
001 Adair
061 Daviess
079 Grundy
081 Harrison
129 Mercer
147 Nodaway
171 Putnam
197 Schuyler
211 Sullivan
227 Worth

MO-2
025 Caldwell
033 Carroll
047 Clay
107 Lafayette
117 Livingston
177 Ray
195 Saline

MO-3
007 Audrain
019 Boone
027 Callaway
041 Chariton
089 Howard
115 Linn
121 Macon
137 Monroe
139 Montgomery
173 Ralls
175 Randolph

MO-4
037 Cass
083 Henry
101 Johnson
159 Pettis
185 St. Clair

MO-5
011 Barton
013 Bates
039 Cedar
057 Dade
097 Jasper
217 Vernon

OK-1
035 Craig
091 McIntosh
101 Muskogee
105 Nowata
107 Okfuskee
111 Okmulgee
131 Rogers
143 Tulsa
145 Wagoner

OK-2
061 Haskell
079 LeFlore
135 Sequoyah

OK-3
005 Atoka
029 Coal
077 Latimer
121 Pittsburg

EASTERN REGION

AL-1
009 Blount
043 Cullman
049 DeKalb
057 Fayette
071 Jackson
073 Jefferson
093 Marion
115 St. Clair
117 Shelby
125 Tuscaloosa
127 Walker
133 Winston

KY-2
019 Boyd
089 Greenup
127 Lawrence

KY-3
025 Breathitt
043 Carter
051 Clay
063 Elliott
109 Jackson
115 Johnson
121 Knox
125 Laurel
129 Lee
153 Magoffin
165 Menifee
175 Morgan
189 Owsley
197 Powell
199 Pulaski
203 Rockcastle
237 Wolfe

KY-4
071 Floyd
119 Knott
133 Letcher
159 Martin
195 Pike

Appendix table 1—Counties included in Coal Production Areas—Continued

EASTERN REGION—Cont'd.

KY-5
013 Bell
095 Harlan
131 Leslie
193 Perry
235 Whitley

KY-6
053 Clinton
147 McCreary
231 Wayne

MD-1
001 Allegany
023 Garrett

OH-1
013 Belmont
019 Carroll
029 Columbiana
031 Coshocton
059 Guernsey
067 Harrison
075 Holmes
081 Jefferson
099 Mahoning
111 Monroe
119 Muskingum
127 Perry
151 Stark
157 Tuscarawas
169 Wayne

OH-2
115 Morgan
121 Noble
167 Washington

OH-3
009 Athens
073 Hocking

OH-4
053 Gallia
079 Jackson
087 Lawrence
105 Meigs
145 Scioto
163 Vinton

PA-1
033 Allegheny
007 Beaver
019 Butler
059 Greene
073 Lawrence
085 Mercer
121 Venango
125 Washington

PA-2
005 Armstrong
009 Bedford
013 Blair
015 Bradford
021 Cambria
023 Cameron
027 Centre
031 Clarion
033 Clearfield
035 Clinton
047 Elk
051 Fayette
057 Fulton
061 Huntington
063 Indiana
065 Jefferson
081 Lycoming
083 McKean
111 Somerset
117 Tioga
129 Westmoreland

TN-1
001 Anderson
013 Campbell
025 Claiborne
035 Cumberland
049 Fentress
129 Morgan
133 Overton
137 Pickett
145 Roane
151 Scott

TN-2
007 Bledsoe
061 Grundy
065 Hamilton
115 Marion
141 Putnam
143 Rhea
153 Sequatchie
175 Van Buren
185 White

VA-1
027 Buchanan
051 Dickenson
105 Lee
167 Russell
169 Scott
185 Tazewell
195 Wise

WV-1
009 Brooke
029 Hancock
051 Marshall
069 Ohio

WV-2
001 Barbour
017 Doddridge
033 Harrison
041 Lewis
049 Marion
061 Monongalia
077 Preston
083 Randolph
091 Taylor
095 Tyler
097 Upshur
103 Wetzel

WV-3
023 Grant
057 Mineral
093 Tucker

WV-4
007 Braxton
013 Calhoun
021 Gilmer
087 Roane
101 Webster

WV-5
005 Boone
011 Cabell
015 Clay
039 Kanawha
043 Lincoln
045 Logan
053 Mason
059 Mingo
079 Putnam
099 Wayne

WV-6
019 Fayette
025 Greenbrier
047 McDowell
055 Mercer
067 Nicholas
075 Pocahontas
081 Raleigh
089 Summers
109 Wyoming

GULF REGION

AL-2
005 Barbour
023 Choctaw
031 Coffee
041 Crenshaw
045 Dale
091 Marengo
109 Pike
119 Sumter
131 Wilcox

AR-2
039 Dallas
053 Grant
103 Ouachita
119 Pulaski
125 Saline

TX-1
001 Anderson
021 Bastrop
029 Bexar
037 Bowie
055 Caldwell
063 Camp
067 Cass
073 Cherokee
159 Franklin
161 Freestone
213 Henderson
287 Lee
289 Leon
331 Milam
343 Morris
379 Rains
395 Robertson
449 Titus
467 Van Zandt
499 Wood

Appendix table 1—Counties included in Coal Production Areas—Continued

GULF REGION—Cont'd.

TX-2
183 Gregg
203 Harrison
315 Marion
365 Panola
401 Rusk
419 Shelby

TX-3
005 Angelina
041 Brazos
051 Burleson
149 Fayette
185 Grimes
225 Houston
313 Madison
347 Nacogdoches
455 Trinity
471 Walker
477 Washington

PACIFIC REGION

AK-1
040 Barrow

AK-2
090 Fairbanks
240 SE Fairbanks
290 Yukon Koyukuk

AK-3
170 Matanuska-Susitna

AK-4
120 Kenai-Cook Inlet
210 Seward

WA-1
073 Whatcom

WA-2
033 King
037 Kittitas
053 Pierce

WA-3
041 Lewis
067 Thurston

Appendix table 2–Coal production, by region and type of mining, 1932-79

Region and type of mining	1932	1935	1940	1945	1950	1955	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979[1]
	Million tons																	
Northern Great Plains:																		
Deep	6.3	7.5	8.2	11.6	6.1	1.8	0.4	0.2	0.2	0.2	0.5	0.4	0.5	0.4	0.5	0.7	0.7	0.7
Surface	1.8	2.4	2.8	5.3	6.0	5.5	4.5	6.2	16.2	21.0	25.3	32.1	41.7	53.6	67.6	84.6	98.2	117.6
Total	8.1	9.9	11.0	16.9	12.1	7.3	4.9	6.4	16.3	21.2	25.8	32.5	42.3	54.1	68.2	85.3	99.0	118.3
Rocky Mountain:																		
Deep	9.7	10.2	11.3	15.7	11.3	9.7	8.1	8.9	9.5	8.9	8.9	9.6	9.6	11.2	12.1	13.6	14.2	15.1
Surface	*	*	*	.1	.4	.4	.7	4.0	8.7	10.4	12.7	14.5	18.9	19.8	25.5	29.1	30.4	36.8
Total	9.7	10.3	11.3	15.8	11.7	10.1	8.9	13.0	18.3	19.3	21.5	24.0	28.6	31.0	37.6	42.7	44.6	51.9
Interior:																		
Deep	52.0	62.2	61.2	87.4	63.2	48.3	41.6	41.9	54.6	47.9	52.2	56.1	54.9	57.6	55.7	53.6	43.4	52.9
Surface	16.5	18.6	30.1	45.3	47.9	48.1	57.1	78.4	95.4	88.4	101.3	93.4	87.6	93.5	92.2	94.3	82.8	91.3
Total	68.5	80.8	91.3	132.7	111.1	96.4	98.7	120.4	149.9	136.3	153.5	149.5	142.5	151.1	147.9	147.9	126.2	144.1
Eastern:																		
Deep	219.5	265.8	334.1	351.3	311.1	283.8	234.5	279.6	274.8	219.0	242.6	233.3	212.4	224.0	226.6	198.1	183.9	232.8
Surface	1.1	2.5	10.2	59.1	68.9	65.9	67.6	91.8	143.0	154.5	144.7	141.5	165.4	172.4	179.4	195.5	185.9	190.5
Total	220.6	268.4	344.3	410.4	380.0	349.6	302.1	371.4	417.8	373.6	387.3	374.8	377.7	396.4	406.0	393.6	369.8	423.2
Gulf:																		
Deep	.6	.7	.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface	.1	.1	*	.1	*	0	0	0	0	0	4.0	6.9	7.7	11.0	14.1	15.9	20.0	26.6
Total	.7	.8	.6	.1	*	0	0	0	0	0	4.0	6.9	7.7	11.0	14.1	15.9	20.0	26.6
Pacific:																		
Deep	1.7	1.7	1.8	1.6	1.1	.8	.3	.1	*	*	*	*	*	*	*	0	0	*
Surface	*	0	*	.2	.2	.4	.7	.9	.6	1.8	3.3	3.9	4.6	4.5	4.8	5.8	5.4	5.7
Total	1.7	1.7	1.8	1.7	1.3	1.3	1.0	.9	.6	1.8	3.3	4.0	4.6	4.5	4.8	5.8	5.4	5.7
U.S. total:[2]																		
Deep	289.7	348.1	417.1	467.5	392.8	344.4	285.0	330.7	339.1	276.1	304.1	299.4	277.5	293.2	294.9	265.9	242.2	301.4
Surface	19.5	23.6	43.2	110.0	123.4	120.2	130.5	181.4	263.8	276.1	291.3	292.4	325.9	354.8	383.6	425.2	423.0	468.6
Total	309.2	371.7	460.3	577.5	516.2	464.6	415.5	512.1	602.9	552.2	595.4	591.7	603.4	648.1	678.5	691.1	665.1	770.0

*Less than 50,000 tons.

[1] Preliminary data.

[2] Includes production from States not in any region.

Sources: (*90, 103, 105*).

Appendix table 3–Coal production, by region, State, and Coal Production Area (CPA), 1978

Region, State, and CPA	Production		
	Deep	Strip	Total
	Thousand tons		
Northern Great Plains (NGP):			
MT-2	0	302	302
MT-4	0	26,290	26,290
MT-5	0	8	8
Total MT	0	26,600	26,600
ND-1	0	1,325	1,325
ND-2	0	9,544	9,544
ND-3	0	3,159	3,159
Total ND	0	14,028	14,028
WY-1	0	2,861	2,861
WY-2	0	29,204	29,204
WY-3	414	15,415	15,829
WY-4	294	10,136	10,430
Not in CPA's	0	5	5
Total WY	708	57,620	58,328
NGP total	708	98,248	98,956
Rocky Mountain (RM):			
AZ-1	0	9,054	9,054
CO-1	594	8,244	9,838
CO-2	0	706	706
CO-3	42	81	123
CO-4	3,167	143	3,310
CO-5	66	48	114
CO-6	569	79	648
CO-7	73	0	73
Total CO	4,511	9,303	13,814
NM-1	0	8,825	8,825
NM-2	0	3,142	3,142
NM-3	576	89	665
Total NM	576	12,056	12,632
UT-1	9,141	0	9,141
RM total	14,228	30,413	44,641
Interior:			
AR-1	3	507	510
Not in CPA's	0	9	9
Total AR	3	516	519
IL-1	0	3,800	3,800
IL-3	6,928	0	6,928
IL-4	1,942	87	2,029
IL-5	4,452	16,807	21,259
IL-6	11,518	3,069	14,587
Total IL	24,841	23,760	48,600
Interior (continued):			
IN-1	0	1,458	1,457
IN-2	0	4,597	4,597
IN-3	552	17,570	18,121
Not in CPA's	0	6	6
Total IN	552	23,630	24,182
IA-1	108	334	442
IA-2	0	9	9
Total IA	108	342	450
KS-3	0	1,226	1,226
KY-1	17,860	21,475	39,335
Not in CPA's	0	119	119
Total KY-1	17,860	21,596	39,456
MO-1	0	842	842
MO-3	0	1,821	1,821
MO-4	0	1,202	1,202
MO-5	0	1,800	1,800
Total MO	0	5,665	5,665
OK-1	0	5,018	5,018
OK-2	2	635	637
OK-3	0	416	416
Total OK	2	6,068	6,070
Interior total	43,366	82,803	126,168
Eastern:			
AL-1	6,169	13,822	19,991
Not in CPA's	0	561	561
Total	6,169	14,383	20,553
KY-2	0	2,487	2,487
KY-3	1,871	20,004	21,875
KY-4	24,929	16,247	41,176
KY-5	12,133	9,617	21,750
KY-6	61	1,066	1,127
Not in CPA's	2,637	5,186	7,817
Total KY	41,624	54,608	96,233
MD-1	382	2,616	2,998
OH-1	9,682	24,135	33,817
OH-2	0	811	811
OH-3	0	846	846
OH-4	2,214	3,541	5,755
Not in CPA's	0	8	8
Total OH	11,897	29,340	41,237

Continued–

Appendix table 3–Coal production, by region, State, and Coal Production Area (CPA), 1978–Continued

Region, State, and CPA	Production		
	Deep	Strip	Total
	Thousand tons		
Eastern (continued):			
PA-1	15,303	8,379	23,682
PA-2	17,524	40,172	57,796
Total PA	32,925	48,551	81,477
TN-1	2,915	5,054	7,969
TN-2	1,235	827	2,062
Total TN	4,150	5,882	10,032
VA-1	21,511	10,435	31,946
WV-1	5,900	268	6,168
WV-2	17,286	7,668	24,954
WV-3	1,209	1,109	2,318
WV-4	164	684	848
WV-5	19,266	6,329	25,595
WV-6	21,389	4,042	25,431
Total WV	65,216	20,099	85,314
Eastern total	183,876	185,914	369,790
Gulf:			
TX-1	0	12,483	12,483
TX-2	0	6,336	6,336
Not in CPA's	0	1,201	1,201
Total TX	0	20,020	20,020
Gulf total	0	20,020	20,020
Pacific:			
AK-2	0	731	731
WA-2	0	14	14
WA-3	0	4,694	4,694
Total WA	0	4,708	4,708
Pacific total	0	5,439	5,439
U.S. total[1]	242,177	422,950	665,127

[1] Includes 113,000 tons from Georgia.

Appendix table 4–Land in public ownership in Coal Production Areas (CPA's), by agency[1]

Region, State, and CPA	Bureau of Land Management	Forest Service[1]	Recreation and wildlife[2]	Military[3]	Other Federal agencies	Total Federal[4]	Indian land[5]	State[6]	Private[7]	Total land area[4] [8]
					1,000 acres					
Northern Great Plains: (NGP):										
MT-1	*	–	29	–	–	29	51	46	958	1,084
MT-2	272	–	2	–	4	279	533	289	4,888	5,989
MT-3	653	–	–	70	*	724	2	166	1,884	2,776
MT-4	894	96	47	251	7	1,295	1,850	543	7,439	11,127
MT-5	690	340	*		59	999	–	279	3,230	4,508
ND-1	10	504	147	349	11	1,021	203	230	8,162	9,616
ND-2	21	386	66	137	6	616	227	158	5,049	6,050
ND-3	33	139	1	7	13	193	*	121	4,482	4,796
SD-1	39	229	–	157	13	438	1,396	426	4,372	6,632
WY-1	51	395	–	5	1	452	–	132	1,036	1,620
WY-2	748	485	–	3	–	1,236	–	434	4,045	5,715
WY-3	2,225	893	1	–	69	3,188	–	598	4,013	7,799
WY-4	5,531	990	16	–	4	6,541	–	325	2,424	9,290
NGP total[4]	11,078	4,457	309	979	187	17,011	4,262	3,747	51,982	77,003
Rocky Mountain (RM):										
AZ-1	813	4,230	866	29	98	6,036	13,496	2,218	3,607	25,357
CO-1	1,496	625	163	–	47	2,331	–	257	1,938	4,526
CO-2	188	334	12	–	*	534	–	123	381	1,038
CO-3	422	751	–	–	5	1,178	–	159	1,046	2,383
CO-4	4,032	3,338	31	56	163	7,620	–	12	3,687	11,319
CO-5	228	1,061	52	–	24	1,365	766	19	1,140	3,290
CO-6	86	215	–	–	3	304	–	227	3,544	4,075
CO-7	19	532	25	183	64	823	–	481	6,129	7,433
NM-1	976	–	21	–	*	997	2,272	107	144	3,520
NM-2	807	580	22	–	*	1,409	2,522	223	1,714	5,868
NM-3	*	12	3	–	–	15	–	209	2,185	2,409
NM-4	947	631	279	39	8	1,904	63	485	1,774	4,226
UT-1	2,790	959	10	–	5	3,764	*	437	819	5,020
UT-2	1,343	270	58	89	9	1,769	427	231	445	2,872
UT-3	4,222	1,326	337	–	691	6,576	–	580	235	7,391
RM total[4]	18,369	14,863	1,879	396	1,118	36,625	19,546	5,767	28,790	90,728
Interior:										
AR-1		933					–			3,095
IL-1		–					–			5,577
IL-2		–					–			4,514
IL-3		–					–			5,878
IL-4		–					–			2,115
IL-5		43					–			2,831
IL-6		24					–			3,610
IN-1	–	–					–			707
IN-2	–	–					–			1,040
IN-3	–	65					–			3,155
IA-1	–	–					–			1,520
IA-2	–	–					–			7,487

See footnotes at end of table.

Appendix table 4–Land in public ownership in Coal Production Areas (CPA's), by agency–Continued

Region, State, and CPA	Bureau of Land Management	Forest Service[1]	Recreation and wildlife[2]	Military[3]	Other Federal agencies	Total Federal[4]	Indian land[5]	State[6]	Private[7]	Total land area[4,8]
					1,000 acres					
KS-1		–					6			1,394
KS-2		–					–			822
KS-3		–					–			2,281
KY-1	–	–					–			3,823
MO-1		–					–			3,434
MO-2		–					–			2,580
MO-3		3					–			4,487
MO-4		–					–			2,325
MO-5		–					–			2,506
OK-1		–					90			3,767
OK-2		202					38			1,829
OK-3		–					44			2,237
Interior total[4]		1,270					179			73,014
Eastern:										
AL-1		97					–			6,337
KY-2	–	–					–			598
KY-3	–	324					–			3,634
KY-4	–	1					–			1,349
KY-5	–	98					–			1,310
KY-6	–	155					–			670
MD-1	–	–					–			696
OH-1		32					–			4,749
OH-2		32					–			934
OH-3		31					–			592
OH-4		75					–			1,791
PA-1	–	–					–			3,271
PA-2	–	247					–			11,560
TN-1	–	–					–			2,840
TN-2	–	–					–			2,205
VA-1	–	91								2,072
WV-1	–	–					–			372
WV-2	–	304					–			3,182
WV-3	–	111					–			787
WV-4	–	65					–			1,388
WV-5	–	–					–			2,970
WV-6	–	310					–			3,637
Eastern total[4]		1,974								56,943

Continued–

See footnotes at end of table.

Appendix table 4–Land in public ownership in Coal Production Areas (CPA's), by agency–Continued

Region, State and CPA	Bureau of Land Management	Forest Service[1]	Recreation and wildlife[2]	Military[3]	Other Federal agencies	Total Federal[4]	Indian land[5]	State[6]	Private[7]	Total land area[4 8]
					1,000 acres					
Gulf:										
AL-2	–	–	–	95	8	102	–			4,552
AR-2	–	53	–	8	•	60	–			2,257
TX-1	–	–	–	185	1	186	–			9,616
TX-2	–	68	–	31	•	100	–			2,650
TX-3	–	284	–	87	•	371	–			5,401
Gulf total[4]		404		405	9	819				24,476
Pacific:										
AK-1										
AK-2										
AK-3										
AK-4										
WA-1	•	482	392	•	•	874	10	76	401	1,361
WA-2	16	869	235	185	14	1,320	2	235	2,361	3,917
WA-3	•	441	•	18	•	459	2	171	1,376	2,008
Pacific total[4 9]	17	1,792	627	203	14	2,653	13	482	4,137	7,286
Total, all CPA's[4 9]	29,464	24,760					24,000			329,450

A blank space indicates that data are not uniformly available by counties, hence not available for CPA's.

•Less than 500 acres.

–Zero.

[1] Includes National Forests and National Grasslands (*80, 81*).

[2] National Park Service and Fish and Wildlife Services.

[3] Includes military installations and Corps of Engineers project areas.

[4] Detail may not add to total because of rounding.

[5] Includes land owned by Indian tribes, allotments to individual Indians, and some Federal land owned by the Bureau of Indian Affairs (*93*).

[6] Includes land granted to States for school purposes and some State parks and State forests.

[7] Obtained by subtracting data in columns to the left from the total.

[8] Excludes water areas. From U.S. Census of Agriculture (*84*).

[9] Excludes Alaska (see text).

Sources: (*94, 122*), except as noted.

Appendix table 5–Land area and major land use in Coal Production Areas (CPA's), 1974

Region, State, and CPA	Land area	Nonfarm land	Land in farms							
			Cropland				Woodland	Pasture, range, and other	Total	Irrigated
			Harvested	Pastured	Other	Total				
	1,000 acres									
Northern Great Plains:										
MT-1	1,084	-40	360	19	305	684	4	437	1,124	1
MT-2	5,989	448	1,058	99	848	2,005	22	3,514	5,541	53
MT-3	2,776	539	303	21	266	590	3	1,644	2,237	11
MT-4	11,127	1,586	410	71	204	685	323	8,534	9,541	97
MT-5	4,508	418	177	23	79	278	36	3,775	4,090	39
ND-1	9,616	923	3,282	420	2,240	5,942	83	2,668	8,693	41
ND-2	6,050	102	1,558	347	531	2,436	85	3,427	5,948	11
ND-3	4,796	53	1,548	301	860	2,709	37	1,998	4,743	3
SD-1	6,632	299	797	126	244	1,168	25	5,140	6,333	5
WY-1	1,620	149	72	34	8	115	6	1,350	1,471	56
WY-2	5,715	683	103	36	38	178	13	4,841	5,032	50
WY-3	7,799	2,731	144	53	12	208	31	4,829	5,068	185
WY-4	9,290	6,955	110	40	5	155	242	1,938	2,335	108
NGP total	77,003	14,846	9,922	1,590	5,641	17,152	910	44,095	62,157	660
Rocky Mountain:										
AZ-1	25,357	6.164	25	24	25	74	3,471	15,648	19,193	26
CO-1	4,526	2,730	132	37	84	253	69	1,473	1,797	68
CO-2	1,038	567	75	18	2	95	12	364	470	91
CO-3	2,383	1,612	26	11	7	44	39	688	772	41
CO-4	11,319	8,759	299	179	37	515	116	1,929	2,560	377
CO-5	3,290	1,728	144	87	23	254	358	950	1,562	116
CO-6	4,075	1,247	44	32	30	106	59	[illegible]	2,829	22
CO-7	7,433	1,639	1,072	217	649	1,938	71	3,785	5,794	463
NM-1	3,520	1,608	22	13	4	39	127	1,746	1,912	29
NM-2	5,868	1,715	8	13	16	39	718	3,398	4,153	9
NM-3	2,409	140	17	30	16	63	536	1,670	2,269	13
NM-4	4,226	2,328	13	11	5	29	6	1,863	1,898	16
UT-1	5,020	4,239	60	38	8	106	32	644	782	82
UT-2	7,391	6,958	23	26	4	53	13	367	433	34
UT-3	2,872	1,464	31	26	16	73	461	874	1,408	52
RM total	90,728	42,896	1,991	762	926	3,679	6,090	38,063	47,832	1,436
Interior:										
AR-1	3,095	2,035	189	332	19	539	248	273	1,060	9
IL-1	5,577	732	3,233	398	168	3,799	453	593	4,845	3
IL-2	4,514	565	3,387	123	69	3,578	118	253	3,949	11
IL-3	5,878	763	3,831	288	156	4,276	340	499	5,114	2
IL-4	2,115	180	1,559	77	49	1,686	111	139	1,935	*
IL-5	2,831	699	1,465	144	105	1,714	227	191	2,132	3
IL-6	3,610	1,030	1,714	236	158	2,108	212	259	2,579	4
IN-1	707	171	341	41	17	399	86	51	536	*
IN-2	1,040	398	386	54	40	481	87	75	642	1
IN-3	3,155	1,053	1,280	221	92	1,593	273	236	2,102	2

See footnotes at end of table.

Continued–

Appendix table 5–Land area and major land use in Coal Production Areas (CPA's), 1974–Continued

Region, State, and CPA	Land area	Nonfarm land	Land in farms							
			Cropland				Wood-land	Pasture, range, and other	Total	Irri-gated
			Har-vested	Pastured	Other	Total				
	1,000 acres									
Interior–Continued:										
IA-1	1,520	232	677	229	40	946	96	247	1,288	*
IA-2	7,487	753	4,510	744	134	5,388	382	964	6,734	1
KS-1	1,394	156	655	196	42	894	58	286	1,238	2
KS-2	822	127	301	89	18	407	36	251	694	2
KS-3	2,281	377	763	240	46	1,050	78	776	1,904	2
KY-1	3,823	1,430	968	520	104	1,591	461	341	2,393	1
MO-1	3,434	505	1,198	763	75	2,035	221	673	2,930	*
MO-2	2,580	391	1,133	443	81	1,657	153	379	2,189	2
MO-3	4,487	941	1,645	708	131	2,484	446	616	3,546	6
MO-4	2,325	506	758	442	40	1,240	180	399	1,819	2
MO-5	2,506	547	855	424	47	1,327	166	466	1,959	13
OK-1	3,767	1,288	454	511	48	1,013	204	1,262	2,479	4
OK-2	1,829	988	110	219	12	341	167	332	841	3
OK-3	2,237	805	89	252	13	354	261	816	1,431	3
Interior total	73,014	16,673	31,500	7,694	1,707	40,900	5,064	10,377	56,341	78
Eastern:										
AL-1	6,337	4,661	378	348	63	790	579	307	1,676	1
KY-2	598	407	17	38	8	64	88	39	191	*
KY-3	3,634	2,260	149	345	68	562	589	224	1,375	*
KY-4	1,349	1,304	3	6	1	10	27	8	45	*
KY-5	1,310	1,237	8	18	3	29	26	18	73	*
KY-6	670	423	40	64	7	111	101	35	247	*
MD-1	696	521	44	28	4	72	69	31	176	*
OH-1	4,749	2,611	837	345	91	1,272	384	481	2,138	2
OH-2	934	553	78	75	13	166	98	117	381	*
OH-3	592	443	33	29	6	67	46	35	149	*
OH-4	1,791	1,230	121	111	22	254	162	146	562	1
PA-1	3,271	2,337	338	177	52	568	172	194	934	1
PA-2	11,560	8,902	1,068	364	118	1,549	718	390	2,658	2
TN-1	2,840	2,111	113	213	22	349	292	88	729	*
TN-2	2,205	1,534	121	206	20	347	232	93	671	*
VA-1	2,072	1,427	80	140	19	239	207	199	646	*
WV-1	372	257	24	28	6	57	31	26	115	*
WV-2	3,182	2,331	128	212	18	357	298	196	851	*
WV-3	787	543	28	41	4	73	113	58	244	*
WV-4	1,388	1,119	29	72	5	106	111	52	268	*
WV-5	2,970	2,651	42	73	13	129	125	66	320	*
WV-6	3,637	3,119	66	91	10	167	210	141	518	*
Eastern total	56,943	41,980	3,744	3,026	572	7,342	4,678	2,944	14,964	9
Gulf:										
AL-2	4,552	2,552	364	321	68	753	773	474	2,000	1

See footnotes at end of table.

Continued–

Appendix table 5 - Land area and major land use in Coal Production Areas (CPA's), 1974–Continued

Region, State, and CPA	Land area	Nonfarm land	Land in farms							
			Cropland				Wood-land	Pasture, range, and other	Total	Irri-gated
			Har-vested	Pastured	Other	Total				
	1,000 acres									
AR-2	2,257	1,927	94	81	13	187	87	56	330	7
TX-1	9,616	3,986	655	1,432	121	2,208	1,046	2,376	5,630	49
TX-2	2,650	1,576	78	329	16	423	313	338	1,074	2
TX-3	5,401	2,282	319	789	50	1,158	588	1,372	2,119	19
Gulf total	24,476	12,324	1,510	2,952	269	4,730	2,806	4,616	12,152	78
Pacific:										
AK-1[1]	36,856	36,856	0	0	0	0	0	0	0	0
AK-2[1]	152,668	152,498	5	*	4	10	6	155	170	*
AK-3[1]	38,884	38,608	10	1	1	12	9	256	276	*
AK-4[1]	10,369	10,316	2	*	*	2	9	42	53	*
WA-1	1,361	1,228	66	27	2	94	16	23	133	25
WA-2	3,917	3,347	80	65	6	151	80	340	570	76
WA-3	2,008	1,805	51	42	5	99	75	28	202	13
Pacific total[2]	7,286	6,380	197	134	13	344	171	391	905	114
Total, all CPA's[2]	329,450	135,099	48,864	16,158	9,128	74,174	19,719	100,486	194,351	2,375

*Less than 500 acres.

[1] Small area data for Alaska not available. Data shown are for Census groupings of districts, each of which is much larger than any CPA.

[2] Excluding Alaska.

Note: Data may not add to total because of rounding.

Source: (*84*).

Appendix table 6–Land use ratios for Coal Production Areas (CPA's), 1974

Region, State, and CPA	Farmland to land area	Cropland to farmland	Harvested cropland to total cropland	Harvested cropland to land area
	Percent			
Northern Great Plains:				
MT-1	103.7	60.8	52.7	33.2
MT-2	92.5	36.2	52.8	17.7
MT-3	80.6	26.4	51.3	10.9
MT-4	85.7	7.2	59.8	3.7
MT-5	90.7	6.8	63.4	3.9
ND-1	90.4	68.4	55.2	34.1
ND-2	98.3	41.0	63.9	25.7
ND-3	98.9	57.1	57.2	32.3
SD-1	95.5	18.4	68.3	12.0
WY-1	90.8	7.8	63.0	4.5
WY-2	88.0	3.5	58.0	1.8
WY-3	65.0	4.1	69.0	1.8
WY-4	25.1	6.6	71.1	1.2
Northern Great Plains average	80.7	26.3	57.8	12.9
Rocky Mountain:				
AZ-1	75.7	3.7	33.7	.1
CO-1	39.7	14.1	52.2	2.9
CO-2	45.3	20.1	79.6	7.3
CO-3	32.4	5.7	59.3	1.1
CO-4	22.6	20.1	58.1	2.6
CO-5	47.5	16.2	56.7	4.4
CO-6	69.4	3.8	41.3	1.1
CO-7	77.9	33.4	55.3	14.4
NM-1	54.3	2.0	56.5	.6
NM-2	70.8	.9	21.9	.1
NM-3	94.2	2.8	26.3	.7
NM-4	44.9	1.5	45.2	.3
UT-1	15.6	13.5	56.4	1.2
UT-2	5.9	12.3	43.0	.3
UT-3	49.0	5.2	42.6	1.1
Rocky Mountain average	52.7	7.7	54.1	2.2
Interior:				
AR-1	34.2	50.8	35.0	6.1
IL-1	86.9	78.4	85.1	58.0
IL-2	87.5	90.6	94.6	75.0
IL-3	87.0	83.6	89.6	65.2
IL-4	91.5	87.1	92.5	73.7
IL-5	75.3	80.4	85.5	51.7
IL-6	71.5	81.7	81.3	47.5

Continued–

Appendix table 6—Land use ratios for Coal Production Areas (CPA's), 1974—Continued

Region, State, and CPA	Farmland to land area	Cropland to farmland	Harvested cropland to total cropland	Harvested cropland to land area
			Percent	
Interior—Continued:				
IN-1	75.8	74.4	85.4	48.2
IN-2	61.7	74.8	80.4	37.1
IN-3	66.6	75.8	80.4	40.6
IA-1	84.7	73.4	71.6	44.5
IA-2	89.9	80.0	83.7	60.2
KS-1	88.8	72.2	73.3	47.0
KS-2	84.5	58.6	73.8	36.6
KS-3	83.5	55.1	72.7	33.5
KY-1	62.6	66.5	60.8	25.3
MO-1	85.3	69.5	58.8	34.9
MO-2	84.9	75.7	68.4	43.9
MO-3	79.0	70.1	66.2	36.7
MO-4	78.2	68.2	61.1	32.6
MO-5	78.2	67.7	64.5	34.1
OK-1	67.5	40.9	44.8	12.0
OK-2	46.0	40.5	32.3	6.0
OK-3	64.0	24.7	25.0	4.0
Interior average	77.2	72.6	77.0	43.1
Eastern:				
AL-1	26.4	47.1	47.9	6.0
KY-2	31.9	33.4	27.3	2.9
KY-3	37.8	40.9	26.5	4.1
KY-4	3.3	23.1	27.7	.2
KY-5	5.6	40.2	28.4	.6
KY-6	36.9	44.9	35.7	5.9
MD-1	25.2	43.2	57.6	6.3
OH-1	45.0	59.5	65.8	17.6
OH-2	40.8	43.5	46.7	8.3
OH-3	25.2	45.3	48.5	5.5
OH-4	31.4	45.3	47.8	6.8
PA-1	28.5	60.8	59.5	10.3
PA-2	23.0	58.3	68.9	9.2
TN-1	25.7	47.9	32.5	4.0
TN-2	30.4	51.7	34.9	5.5
VA-1	31.2	37.1	33.5	3.9

Continued—

Appendix table 6–Land use ratios for Coal Production Areas (CPA's), 1974–Continued

Region, State, and CPA	Farmland to land area	Cropland to farmland	Harvested cropland to total cropland	Harvested cropland to land area
	Percent			
Eastern–Continued:				
WV-1	30.8	49.8	41.4	6.4
WV-2	26.7	42.0	35.8	4.0
WV-3	31.0	29.9	37.8	3.5
WV-4	19.3	39.4	27.4	2.1
WV-5	10.8	40.3	33.0	1.4
WV-6	14.2	32.2	39.4	1.8
Eastern average	26.3	49.1	51.0	6.6
Gulf:				
AL-2	43.9	37.7	48.3	8.0
AR-2	14.6	56.7	50.1	4.2
TX-1	58.5	39.2	29.7	6.8
TX-2	40.5	39.4	18.5	3.0
TX-3	57.7	37.1	27.5	5.9
Gulf average	49.6	38.9	31.9	6.2
Pacific:				
AK-1[1]	N	N	N	N
AK-2[1]	N	5.6	49.7	N
AK-3[1]	N	4.4	83.5	N
AK-4[1]	N	3.8	80.5	N
WA-1	9.8	71.0	69.7	4.8
WA-2	14.6	26.4	53.2	2.0
WA-3	10.1	48.8	52.2	2.6
Pacific average[1]	12.5	37.9	57.3	2.7
All CPA's average[1]	59.0	38.2	65.9	14.8

[1] Excluding Alaska.

N = No meaningful figure.

Source: *(84)*.

Appendix table 7–Three leading crops in each Coal Production Area (CPA), 1974

Region, State, and CPA	Cropland harvested[1]	First		Second		Third	
	1,000 acres	*Crop*	*Percent*	*Crop*	*Percent*	*Crop*	*Percent*
Northern Great Plains:							
MT-1	360	Wheat	82.3	Hay	9.4	Small grains[2]	8.5
MT-2	1,058	Wheat	68.1	Hay	15.9	Small grains	13.2
MT-3	303	Wheat	70.3	Hay	14.2	Small grains	13.8
MT-4	410	Wheat	42.0	Hay	34.7	Small grains	15.4
MT-5	177	Hay	50.6	Wheat	28.3	Small grains	10.9
ND-1	3,282	Wheat	66.9	Hay	19.5	Small grains	13.4
ND-2	1,558	Wheat	40.7	Hay	36.7	Small grains	18.3
ND-3	1,548	Wheat	54.4	Hay	27.4	Small grains	15.8
SD-1	797	Hay	43.5	Wheat	38.8	Small grains	13.7
WY-1	72	Hay	77.3	Small grains	13.9	Wheat	8.0
WY-2	103	Hay	62.4	Wheat	25.8	Small grains	11.8
WY-3	144	Hay	90.0	Wheat	4.8	Small grains	4.2
WY-4	110	Hay	81.1	Small grains	18.0	Wheat	1.6
Northern Great Plains total or percent	9,922	Wheat	55.2	Hay	28.2	Small grains	14.3
Rocky Mountain:							
AZ-1	25	Hay	43.9	Corn	37.1	Orchards	5.2
CO-1	132	Hay	50.0	Wheat	43.5	Small grains	6.1
CO-2	75	Hay	100.0	–	–	–	–
CO-3	26	Hay	95.6	Corn	1.4	Wheat	1.4
CO-4	299	Hay	65.2	Corn	17.3	Small grains	7.9
CO-5	144	Dry beans	35.4	Hay	32.6	Wheat	27.1
CO-6	44	Hay	55.3	Wheat	34.2	Sorghum	5.2
CO-7	1,072	Wheat	50.0	Hay	19.1	Corn	17.7
NM-1	22	Hay	76.5	Corn	13.2	Wheat	2.3
NM-2	8	Hay	60.7	Corn	16.3	Vegetables	W
NM-3	17	Hay	87.5	Wheat	8.0	Small grains	2.9
NM-4	13	Hay	59.2	Sorghum	19.6	Corn	15.2
UT-1	60	Hay	67.1	Small grains	14.9	Corn	12.3
UT-2	23	Hay	80.4	Small grains	12.4	Wheat	4.0
UT-3	31	Hay	70.5	Corn	13.5	Wheat	7.3
Rocky Mountain total or percent	1,991	Hay	38.2	Wheat	34.8	Corn	12.6
Interior:							
AR-1	189	Hay	58.1	Soybeans	32.2	Wheat	4.4
IL-1	3,233	Corn	55.3	Soybeans	32.0	Hay	6.4
IL-2	3,387	Corn	54.5	Soybeans	39.8	Hay	2.2
IL-3	3,831	Corn	43.8	Soybeans	43.3	Wheat	9.8
IL-4	1,559	Soybeans	45.5	Corn	44.0	Wheat	7.8
IL-5	1,465	Soybeans	39.2	Corn	27.3	Wheat	25.7
IL-6	1,714	Soybeans	48.6	Corn	26.1	Wheat	20.4

See footnotes at end of table.

Continued–

Appendix table 7–Three leading crops in each Coal Production Area (CPA), 1974–Continued

Region, State, and CPA	Cropland harvested[1]	First		Second		Third	
	1,000 acres	*Crop*	*Percent*	*Crop*	*Percent*	*Crop*	*Percent*
Interior–Continued:							
IN-1	341	Corn	46.1	Soybeans	36.8	Wheat	10.7
IN-2	386	Corn	39.7	Soybeans	38.1	Wheat	15.6
IN-3	1,280	Corn	48.0	Soybeans	28.4	Wheat	16.5
IA-1	677	Corn	48.1	Soybeans	28.9	Hay	17.2
IA-2	4,510	Corn	53.2	Soybeans	34.4	Hay	8.7
KS-1	655	Corn	31.2	Sorghum	24.8	Soybeans	15.3
KS-2	301	Soybeans	28.5	Sorghum	22.0	Hay	21.9
KS-3	763	Wheat	33.1	Soybeans	25.9	Hay	17.8
KY-1	968	Soybeans	39.6	Corn	38.4	Hay	15.3
MO-1	1,198	Corn	34.9	Hay	32.4	Soybeans	29.2
MO-2	1,133	Soybeans	38.6	Corn	36.1	Hay	16.5
MO-3	1,645	Soybeans	41.6	Corn	26.1	Hay	20.7
MO-4	758	Hay	27.6	Soybeans	24.3	Corn	21.1
MO-5	855	Soybeans	27.2	Hay	22.3	Wheat	19.7
OK-1	454	Hay	43.9	Soybeans	25.1	Wheat	14.4
OK-2	110	Hay	57.5	Soybeans	29.8	Wheat	7.0
OK-3	89	Hay	74.4	Sorghum	6.6	Wheat	3.3
Interior total or percent	31,500	Corn	40.4	Soybeans	36.2	Hay	11.1
Eastern:							
AL-1	378	Corn	28.6	Hay	23.5	Soybeans	23.5
KY-2	17	Hay	58.0	Corn	27.6	Soybeans	7.5
KY-3	149	Hay	59.3	Corn	30.4	Tobacco	9.4
KY-4	3	Hay	54.3	Corn	39.7	Soybeans	3.1
KY-5	8	Hay	61.3	Corn	32.2	Tobacco	3.0
KY-6	40	Hay	49.7	Corn	31.5	Wheat	7.3
MD-1	44	Hay	56.8	Corn	22.0	Small grains	13.5
OH-1	837	Hay	40.4	Corn	37.4	Small grains	9.8
OH-2	78	Hay	64.6	Corn	25.2	Wheat	5.0
OH-3	33	Hay	58.6	Corn	27.4	Wheat	4.7
OH-4	121	Hay	49.3	Corn	31.1	Soybeans	9.7
PA-1	338	Hay	51.8	Corn	28.4	Small grains	14.1
PA-2	1,068	Hay	52.9	Corn	29.1	Small grains	14.1
TN-1	113	Hay	63.2	Corn	22.4	Vegetables	8.3
TN-2	121	Hay	53.4	Corn	25.0	Soybeans	12.7
VA-1	80	Hay	71.1	Corn	21.6	Tobacco	6.0
WV-1	24	Hay	78.0	Corn	12.8	Small grains	4.6
WV-2	128	Hay	88.4	Corn	9.0	Small grains	2.2
WV-3	28	Hay	76.7	Corn	16.8	Small grains	3.1

See footnotes at end of table.

Continued–

Appendix table 7--Three leading crops in each Coal Production Area (CPA), 1974--Continued

Region, State, and CPA	Cropland harvested[1]	First		Second		Third	
	1,000 acres	*Crop*	*Percent*	*Crop*	*Percent*	*Crop*	*Percent*
Eastern--Continued:							
WV-4	29	Hay	94.5	Corn	3.8	Orchards	.9
WV-5	42	Hay	61.6	Corn	28.0	Soybeans	4.0
WV-6	66	Hay	81.5	Corn	14.6	Small grains	2.2
Eastern total or percent	3,744	Hay	50.7	Corn	29.0	Small grains	8.1
Gulf:							
AL-2	364	Corn	31.6	Peanuts	25.0	Hay	17.8
AR-2	94	Soybeans	49.4	Hay	23.0	Cotton	19.0
TX-1	655	Hay	45.5	Sorghum	25.6	Cotton	10.3
TX-2	78	Hay	89.5	Vegetables	3.4	Corn	2.9
TX-3	319	Hay	56.3	Sorghum	19.9	Cotton	10.7
Gulf total or percent	1,510	Hay	41.2	Sorghum	15.6	Corn	11.7
Pacific:							
AK-1	0	–	–	–	–	–	–
AK-2 (Fairbanks)	5	Hay	47.8	Other[3]	38.1	Small grains	9.5
AK-3 (Anchorage)	10	Hay	[4]	Small grains	6.3	Potatoes	3.5
AK-4 (Ken./Cook)	2	Hay	96.0	Small grains	2.7	Potatoes	1.0
WA-1	66	Hay	71.1	Vegetables	17.8	Corn	9.7
WA-2	80	Hay	65.1	Wheat	11.3	Vegetables	9.1
WA-3	51	Hay	81.8	Vegetables	6.8	Small grains	5.7
Pacific total or percent	214	Hay	71.9	Vegetables	10.6	Corn	5.4

- = Not applicable.

W = Data withheld to prevent disclosure.

[1] Detail may not add to total because of rounding.

[2] All small grains includes oats, barley, rye, and mixed grains.

[3] "Other Crops" not identified as to kind.

[4] Data internally inconsistent--probably about 90 percent.

Source: *(84)*.

Appendix table 8–Total gross farm sales per farm and per acre, 1974

Region, State, and Coal Production Area	Livestock	Crops	Total	Commercial farms	Other farms	Income per commercial farm	Average per acre of–	
							Land area	Farmland
	1,000 dollars					Dollars		
Northern Great Plains:								
MT-1	3,877	25,358	29,236	29,188	48	44,426	26.96	26.01
MT-2	42,322	81,615	123,936	123,690	246	55,194	20.69	22.37
MT-3	12,533	22,625	35,159	35,129	30	52,198	12.67	15.72
MT-4	50,637	32,858	83,496	83,320	176	63,700	7.50	8.75
MT-5	24,835	10,449	35,285	34,515	770	52,856	7.83	8.63
ND-1	55,308	240,649	295,956	295,282	674	37,420	30.78	34.05
ND-2	62,260	59,714	121,975	121,301	674	30,295	20.16	20.51
ND-3	47,173	82,923	130,098	129,795	303	38,153	27.13	27,43
SD-1	39,291	24,634	63,925	63,615	310	35,263	9.59	10.09
WY-1	10,975	1,870	12,844	12,689	155	35,845	7.93	8.73
WY-2	20,306	2,666	22,971	22,901	70	38,296	4.02	4.57
WY-3	25,897	2,415	28,312	28,240	72	62,340	3.63	5.59
WY-4	12,534	2,966	15,500	15,323	177	30,769	1.67	6.64
Northern Great Plains total or average	407,948	590,742	998,693	994,988	3,705	40,552	12.97	16.07
Rocky Mountain:								
AZ-1	24,514	1,578	26,091	14,159	11,932	38,898	1.03	1.36
CO-1	12,750	5,930	18,680	18,632	48	39,391	4.13	10.40
CO-2	4,101	1,430	5,531	5,526	5	63,517	5.33	11.39
CO-3	5,338	1,276	6,615	5,695	920	27,380	2.78	8.57
CO-4	58,361	33,874	92,236	90,840	1,396	36,927	8.15	36.03
CO-5	10,377	6,936	17,313	16,618	695	21,526	5.26	11.08
CO-6	10,335	1,469	11,804	11,614	190	26,276	2.90	4.17
CO-7	555,386	170,448	725,834	724,571	1,263	144,741	97.65	125.27
NM-1	2,888	2,697	5,585	3,517	2,068	17,585	1.59	2.92
NM-2	6,383	1,296	7,679	3,883	3,796	19,913	1.31	1.85
NM-3	10,869	1,084	11,953	11,840	113	58,614	4.96	5.27
NM-4	5,328	2,294	7,623	7,428	195	34,549	1.80	4.02
UT-1	14,955	3,127	18,082	17,661	421	26,558	3.60	23.12
UT-2	4,266	659	4,925	4,754	171	23,078	.67	11.37
UT-3	6,028	1,067	7,096	6,192	904	20,709	2.47	5.04
Rocky Mountain total or average	731,879	235,165	967,047	942,930	24,117	77,950	10.66	20.22
Interior:								
AR-1	106,517	15,000	121,516	118,451	3,065	45,523	39.26	114.63
IL-1	345,235	456,476	801,712	799,138	2,574	48,841	143.76	165.48
IL-2	129,403	588,853	718,255	716,726	1,529	55,273	159.10	181.88
IL-3	213,128	633,466	846,596	843,053	3,543	51,128	144.04	165.53
IL-4	50,752	257,439	308,192	307,192	1,000	50,434	145.69	159.25
IL-5	104,455	163,715	268,168	265,765	2,403	32,230	94.72	125.77
IL-6	66,600	191,056	257,651	254,974	2,677	29,752	71.38	99.89

Continued–

Appendix table 8–Total gross farm sales per farm and per acre, 1974–Continued

Region, State, and Coal Production Area	Livestock	Crops	Total	Commercial farms	Other farms	Income per commercial farm	Average per acre of–	
							Land area	Farmland
	1,000 dollars					Dollars		
Interior–Continued:								
IN-1	17,606	47.187	64,790	64,393	397	40,448	91.61	120.94
IN-2	18,433	50,443	68,874	67,611	1,263	28,564	66.21	107.25
IN-3	137,061	180,451	317,512	314,874	2,638	39,762	100.63	151.02
IA-1	112,159	63,094	175,253	174,105	1,148	37,036	115.29	136.05
IA-2	530,056	647,428	1,177,487	1,171,683	5,804	50,091	157.28	174.86
KS-1	59,962	49,784	109,747	107,645	2,102	31,256	78.74	88.64
KS-2	22,817	20,095	42,912	42,358	554	24,316	52.22	61.80
KS-3	65,808	58,865	124,674	123,301	1,373	30,864	54.65	65.47
KY-1	72,858	158,359	231,221	225,667	5,554	25.531	60.48	96.62
MO-1	116,244	91,250	207,493	204,777	2,716	26.116	60.42	70.83
MO-2	109,300	111,335	220,632	218,575	2,057	32,903	85.52	100.78
MO-3	146,480	148,663	295,141	291,003	4.138	29,045	65.77	83.23
MO-4	75,367	58,734	134,100	131,770	2,330	25,018	57.67	73.73
MO-5	72,105	67,854	139,960	137,590	2,370	25,771	55.86	71.45
OK-1	62,792	31,094	93,887	89.664	4,223	20,254	24.93	37.87
OK-2	18,825	7,708	26,533	24,707	1,826	17,241	14.51	31.56
OK-3	22,478	3,889	26,367	23.908	2,459	14,138	11.79	18.42
Interior total or average	2,676.441	4,102,238	6,778,673	6,718,930	59,743	39.069	92.84	120.31
Eastern:								
AL-1	261,883	52,670	314,552	307,278	7,274	44,462	14.63	187.69
KY-2	5,469	3,267	8,736	7,846	890	13,551	14.60	45.74
KY-3	27,006	36,441	63,447	54,706	8,741	9,564	17.46	46.16
KY-4	478	231	708	505	203	10,745	.52	15.74
KY-5	1,435	839	2,274	1.764	510	10,080	1.74	31.04
KY-6	7,688	6.792	14,480	13,141	1,339	11,568	21.60	58.61
MD-1	10,853	2,453	13,307	12,888	419	26,089	19.12	76.04
OH-1	164.484	68.252	232,735	225,680	7,055	25,512	49.01	108.86
OH-2	11,104	4,321	15,425	13,833	1,592	14.795	16.52	40.47
OH-3	3,818	1,913	5,731	5,151	580	13,997	9.68	38.48
OH-4	24,285	12,879	37,163	34,742	2,421	10,013	20.74	66.14
PA-1	58,846	34,128	92,973	88,533	4,440	23,502	28.42	99.58
PA-2	223,659	71,516	295,167	287,074	8,093	31,422	25.53	111.05
TN-1	24,666	14,279	38,944	34,345	4,599	13,089	13.71	53.45
TN-2	32,740	12,273	45,013	41,830	3,183	17,524	20.42	67.09
VA-1	15,535	12,471	28,007	23,822	4,185	10,644	13.51	43.38
WV-1	3,569	1,865	5,434	4,960	474	17,778	14.60	47.38
WV-2	16,369	4,745	21,113	17,521	3.592	12,874	6.64	24.82

Continued–

Appendix table 8—Total gross farm sales per farm and per acre, 1974—Continued

Region, State, and Coal Production Area	Livestock	Crops	Total	Commercial farms	Other farms	Income per commercial farm	Average per acre of–	
							Land area	Farmland
	1,000 dollars					*Dollars*		
Eastern–Continued:								
WV-3	5,777	1,285	7,062	6,463	599	18,519	8.98	28.94
WV-4	2,289	715	3,002	2,101	901	6,670	2.16	11.20
WV-5	8,068	4,491	12,559	10,489	2,070	15,797	4.23	39.30
WV-6	12,571	2,498	15,070	13,196	1,874	15,326	4.14	29.08
Eastern total or average	922,592	350,324	1,272,902	1,207,868	65,034	23,717	22.35	85.07
Gulf:								
AL-2	59,730	55,716	115,446	112,341	3,105	31,574	25.36	153.31
AR-2	16,459	12,432	28,893	27,854	1,039	40,251	12.80	154.51
TX-1	203,163	60,951	264,116	251,533	12,583	25,870	27.47	119.62
TX-2	80,471	5,479	85,948	82,818	3,130	37,474	32.43	203.19
TX-3	116,784	24,148	140,931	130,341	10,590	25,632	26.09	121.70
Gulf total or average	476,607	158,726	635,334	604,887	30,447	28,441	25.96	134.32
Pacific:								
AK-1	0	0	0	0	0	0	–	–
AK-2	666	965	1,631	1,577	54	35,841	.01	9.57
AK-3	2,847	1,624	4,472	4,336	136	41,692	.12	16.19
AK 4	82	255	337	320	17	12,308	.03	6.34
WA-1	41,825	12,965	54,790	54,177	613	52,856	40.27	412.20
WA-2	71,832	27,091	98,925	97,144	1,781	59,090	25.25	173.40
WA-3	35,887	9,317	45,205	44,317	888	56,671	22.52	223.47
Pacific total or average	153,139	52,217	205,360	201,871	3,489	92,512	.56	103.87

– = Not applicable.

Source: *(84)*.

Appendix table 9–Projected coal production from surface mines, land used for mining, and value of production displaced, by region, State, and Coal Production Areas (CPA's), 1975-99

Region, State, and CPA	Average annual coal production, 1975-99[1]	New or expanded mines[1]	Coal yield per acre[2]	Average annual acreage taken out of production[3]	Value of production displaced		Ratio[6]
					Per acre[4]	Total[5]	
	Million tons	*Number*	*Tons*	*Acres*	*Dollars*	*1,000 dollars*	*Percent*
Northern Great Plains:							
MT-1	0	0	29,400	0	26.96	0	–
MT-2	.3	0	25,200	95	20.69	2	*
MT-3	1.8	1	22,528	1,439	12.67	18	0.05
MT-4	58.6	10	42,480	19,036	7.50	143	.17
MT-5	0	0	33,792	0	7.83	0	–
ND-1	8.6	5	11,200	7,839	30.78	241	.08
ND-2	20.7	5	16,800	10,161	20.16	205	.17
ND-3	4.9	3	22,400	3,494	27.13	95	.07
SD-1	0	0	7,000	0	9.59	0	–
WY-1	8.4	5	29,736	6,260	7.93	50	.39
WY-2	141.8	19	100,608	26,475	4.02	106	.46
WY-3	31.7	10	34,761	15,296	3.63	56	.20
WY-4	19.2	8	21,599	13,511	1.67	23	.15
Northern Great Plains total or average	296.0	66	47,870	103,606	9.06	939	.09
Rocky Mountain:							
AZ-1	11.7	1	14,160	9,063	1.03	9	.04
CO-1	9.1	3	16,416	7,943	4.13	33	.18
CO-2	2.4	2	34,560	2,294	5.33	12	.22
CO-3	0	0	8,640	0	2.78	0	–
CO-4	10.3	5	19,563	9,265	8.15	76	.08
CO-5	0	0	19,563	0	5.26	0	–
CO-6	.2	0	19,563	102	2.90	*	*
CO-7	0	0	19,563	0	97.65	0	–
NM-1	12.4	8	15,840	14,228	1.59	23	.41
NM-2	15.6	6	11,323	18,577	1.31	24	.32
NM-3	.4	1	15,000	1,067	4.96	5	.04
NM-4	0	0	15,000	0	1.80	0	–
UT-1	*	0	7,200	*	3.60	*	*
UT-2	3.6	1	10,080	4,371	.67	3	.06
UT-3	0	0	21,857	0	2.47	0	–
Rocky Mountain total or average	65.8	27	16,280	66,910	2.76	185	.02

Continued–

See footnotes at end of table.

Appendix table 9–Projected coal production from surface mines, land used for mining, and value of production displaced, by region, State, and Coal Production Areas (CPA's), 1975-99–Continued

Region, State, and CPA	Average annual coal production, 1975-99[1]	New or expanded mines[1]	Coal yield per acre[2]	Average annual acreage taken out of production[3]	Value of production displaced		Ratio[6]
					Per acre[4]	Total[5]	
	Million tons	*Number*	*Tons*	*Acres*	*Dollars*	*1,000 dollars*	*Percent*
Interior:							
AR-1	.5	0	3,000	833	39.26	33	.03
IL-1	7.5	3	4,560	10,024	143.76	1,441	.18
IL-2	0	0	4,200	0	159.10	0	–
IL-3	.4	0	3,960	505	144.04	73	.01
IL-4	.1	0	4,920	102	145.69	15	*
IL-5	18.5	3	8,400	12,812	94.72	1,214	.45
IL-6	5.7	3	6,600	6,118	71.38	437	.17
IN-1	2.5	0	6,000	2,083	91.61	191	.29
IN-2	8.5	3	5,880	9,028	66.21	598	.87
IN-3	24.3	5	5,880	23,663	100.63	2,381	.75
IA-1	.3	0	4,320	347	115.29	40	.02
IA-2	0	0	4,320	0	157.28	0	–
KS-1	0	0	2,040	0	78.74	0	–
KS-2	0	0	1,680	0	52.22	0	–
KS-3	2.6	3	3,000	6,133	54.65	335	.27
KY-1	31.7	4	5,400	31,752	60.48	1,920	.83
MO-1	1.0	0	3,840	1,302	60.42	79	.04
MO-2	0	0	2,760	0	85.52	0	–
MO-3	1.7	0	2,880	2,951	65.77	194	.07
MO-4	1.6	0	2,760	2,899	57.67	167	.12
MO-5	2.5	0	2,640	4,735	55.86	264	.19
OK-1	5.3	2	2,280	12,823	24.93	320	.34
OK-2	1.0	2	3,360	2,688	14.51	39	.15
OK-3	0.5	2	4,440	1,763	11.79	21	.08
Interior total or average	116.0	30	5,040	132,561	73.64	9,762	.14
Eastern:							
AL-1	18.0	7	3,000	32,800	14.63	480	.15
KY-2	2.2	0	5,280	2,083	14.60	30	.35
KY-3	22.3	8	4,920	25,863	17.46	452	.71
KY-4	18.1	3	5,040	19,156	.52	10	1.41
KY-5	15.6	2	5,400	15,244	1.74	27	1.17
KY-6	.8	0	4,800	833	21.60	18	.12
MD-1	2.8	0	4,200	3,333	19.12	64	.48

See footnotes at end of table.

Continued–

Appendix table 9–Projected coal production from surface mines, land used for mining, and value of production displaced, by region, State, and Coal Production Areas (CPA's), 1975-99–Continued

Region, State, and CPA	Average annual coal production, 1975-99[1]	New or expanded mines[1]	Coal yield per acre[2]	Average annual acreage taken out of production[3]	Value of production displaced		Ratio[6]
					Per acre[4]	Total[5]	
	Million tons	*Number*	*Tons*	*Acres*	*Dollars*	*1,000 dollars*	*Percent*
Eastern–Continued:							
OH-1	27.8	2	5,400	26,541	49.01	1,301	.56
OH-2	2.8	1	5,520	2,936	16.52	49	.31
OH-3	1.2	0	6,960	862	9.68	8	.15
OH-4	3.4	0	5,040	3,373	20.74	70	.19
PA-1	6.9	0	5,520	6,250	28.42	178	.19
PA-2	40.7	5	4,680	45,483	25.53	1,161	.39
TN-1	2.8	0	4,680	2,991	13.71	41	.11
TN-2	.2	0	4,320	232	20.42	5	.01
VA-1	14.1	0	5,040	13,988	13.51	189	.67
WV-1	.1	0	5,280	95	14.60	1	.03
WV-2	10.9	3	6,120	10,105	6.64	67	.32
WV-3	1.1	0	5,280	1,042	8.98	9	.13
WV-4	0.5	0	4,920	508	2.16	1	.04
WV-5	7.7	3	5,760	7,884	4.23	33	.27
WV-6	4.7	0	5,520	4,257	4.14	18	.12
Eastern total or average	204.7	34	5,520	225,859	18.65	4,212	.33
Gulf:							
AL-2	0	0	7,140	0	25.36	0	–
AR-2	4.2	1	4,760	5,012	12.80	64	.22
TX-1	33.9	6	10,500	19,743	27.47	542	.21
TX-2	13.6	2	10,500	7,676	32.43	249	.29
TX-3	6.0	3	8,400	5,371	26.09	140	.10
Gulf total or average	57.7	12	[7] 10,220	37,802	26.32	995	.16

See footnotes at end of table.

Continued–

Appendix table 9–Projected coal production from surface mines, land used for mining, and value of production displaced, by region, State, and Coal Production Areas (CPA's), 1975-99–Continued

Region, State, and CPA	Average annual coal production, 1975-99[1]	New or expanded mines[1]	Coal yield per acre[2]	Average annual acreage taken out of production[3]	Value of production displaced		Ratio[6]
					Per acre[4]	Total[5]	
	Million tons	*Number*	*Tons*	*Acres*	*Dollars*	*1,000 dollars*	*Percent*
Pacific:							
AK-1	0	0	na	0	–	0	–
AK-2	1.2	1	na	na	0.01	•	–
AK-3	0	0	na	0	0.12	0	–
AK-4	0	0	na	0	0.03	0	–
WA-1	0	0	31,150	0	40.27	0	–
WA-2	0	0	31,150	0	25.25	0	–
WA-3	4.7	1	31,150	1,554	22.52	35	.08
Pacific total or average	5.9	2	[8]31,150	1,554	22.52	35	.02

– = Not applicable.

na = Not available.

•Less than half the indicated unit.

[1] Based on expansion plans of mining companies. For Northern Great Plains, Rocky Mountain, Gulf, and Pacific Regions, plans are those reported to DOE (*92*). For other regions, plans are those reported in 1979 Keystone Manual (*44*).

[2] Computed from data in Averitt (*3*) and U.S. Bureau of Mines (*106*). Based on 80 percent recovery rate and yield of 1,400 tons per acre-foot for lignite, 1,416 for subbituminous, and 1,440 for bituminous.

[3] Computed as follows: $AA = \frac{ACP \times RP}{CY} + APS$, where:

AA = average annual land out of production;
ACP = annual coal production, in tons;
CY = coal yield per acre;
RP = reclamation period = years required for reclamation = 10 years in Rocky Mountain Region, 8 years in Montana and Wyoming, 5 years in North Dakota, and 5 years in other regions;
APS = acres in permanent structures, arbitrarily assumed to be 800 acres for each new or expanded mine in Northern Great Plains, Rocky Mountain, and Pacific Region; 600 acres in Interior and Gulf Regions; and 400 in Eastern Region.

[4] From appendix table 8.

[5] Column 4 x column 5.

[6] Value of production displaced as a percentage of all farm products in the CPA's of the region.

[7] Includes Texas only.

[8] Includes Washington only.

Appendix table 10–Population trends in Coal Production Areas (CPA's), 1940-75

Region, State, and CPA	Total population					Change, 1950-60			Change, 1960-70			Change, 1970-75		
	1940	1950	1960	1970	1975	Total	Natural	Net migration	Total	Natural	Net migration	Total	Natural	Net migration
	Thousands					Percent								
Northern Great Plains:														
MT-1	7.8	6.7	6.4	5.8	5.4	-3.2	17.2	-20.5	-10.5	7.3	-17.8	-6.6	0.3	-6.9
MT-2	34.5	34.6	40.2	37.0	35.6	16.3	26.0	-9.7	-8.1	13.2	-21.3	-3.8	4.8	-8.6
MT-3	6.2	5.6	5.6	4.6	4.6	.1	20.4	-20.4	-17.9	7.1	-25.0	-.6	3.7	-4.3
MT-4	26.8	25.4	24.4	22.7	26.4	-3.8	17.0	-20.8	-7.0	12.3	-19.3	16.3	6.2	10.1
MT-5	13.6	15.4	15.7	15.0	14.3	2.3	17.9	-15.6	-4.3	9.1	-13.4	-4.7	2.6	-7.3
ND-1	103.6	111.4	123.1	122.0	122.0	10.4	21.1	-10.7	-.9	14.6	-15.5	nc	4.7	-4.7
ND-2	70.8	69.2	75.4	78.2	85.6	8.9	22.7	-13.8	3.8	14.8	-11.1	9.4	4.9	4.5
ND-3	42.6	41.6	41.5	38.9	38.2	-.2	22.3	-22.5	-6.3	14.3	-20.5	-1.8	3.6	-5.4
SD-1	22.0	20.2	19.4	16.8	17.7	-4.0	21.2	-25.2	-13.5	15.3	-28.7	5.4	6.0	-.6
WY-1	19.2	20.2	19.0	17.8	19.9	-5.9	10.1	-16.0	-6.0	2.3	-8.3	11.8	nc	11.8
WY-2	11.0	9.5	11.3	18.5	18.2	18.8	17.3	1.5	63.6	14.0	49.6	-1.9	5.6	-7.5
WY-3	19.3	21.7	21.3	19.3	24.7	-1.7	16.2	-18.0	-9.4	8.5	-17.9	28.0	4.7	23.3
WY-4	29.7	31.0	26.9	27.0	40.5	-13.2	16.7	-29.9	.3	11.8	-11.4	49.8	7.6	42.2
Northern Great Plains total or average	407.2	412.6	430.4	423.7	453.1	4.3	20.3	-15.9	-1.6	12.9	-14.5	6.9	4.6	2.3
Rocky Mountain:														
AZ-1	68.2	81.1	110.3	128.3	164.4	36.0	49.3	-13.4	16.4	38.0	-21.6	28.1	13.1	15.0
CO-1	15.6	14.9	13.0	12.9	18.1	-12.9	14.2	-27.2	1.2	10.4	-9.2	40.0	6.0	34.0
CO-2	1.8	2.0	1.8	1.8	1.8	-11.0	21.4	-32.4	3.0	12.6	-9.6	.5	11.6	-11.1
CO-3	23.0	20.2	22.0	24.0	29.6	8.8	5.0	3.8	9.6	1.0	8.5	23.1	.2	22.9
CO-4	89.3	97.4	111.2	123.1	142.1	14.2	15.2	-.9	10.6	9.0	1.6	15.4	3.0	12.4
CO-5	29.8	27.9	35.9	34.9	41.4	28.6	23.2	5.4	-2.8	12.1	-14.9	18.7	4.6	14.0
CO-6	48.5	36.5	27.9	22.4	22.1	-23.6	11.3	-34.9	-19.8	4.3	-24.1	-1.4	-.6	-0.9
CO-7	246.0	342.8	655.3	1,042.0	1,297.0	91.1	27.7	63.5	59.0	18.8	40.2	24.5	7.1	17.4
NM-1	17.1	18.3	53.3	52.5	65.3	191.4	63.2	128.2	-1.5	24.9	-26.4	24.3	9.6	14.7
NM-2	37.5	39.9	51.4	60.7	73.8	28.9	34.7	-5.8	18.1	33.1	-15.0	21.6	11.7	9.9
NM-3	18.7	16.8	13.8	12.2	12.9	-17.6	14.9	-32.5	-11.8	11.6	-23.4	6.0	3.5	2.5
NM-4	11.4	9.7	10.2	9.8	9.8	5.1	23.1	-18.0	-4.0	21.9	-25.9	.4	7.6	-7.2

See footnotes at end of table.

Continued–

Appendix table 10–Population trends in Coal Production Areas (CPA's), 1940-75–Continued

Region, State, and CPA	Total population					Change, 1950-60			Change, 1960-70			Change, 1970-75		
	1940	1950	1960	1970	1975	Total	Natural	Net migration	Total	Natural	Net migration	Total	Natural	Net migration
	Thousands					Percent								
Rocky Mountain–Continued:														
UT-1	37.6	43.3	37.2	30.9	36.1	-13.9	19.4	-33.4	-17.1	8.3	-25.4	16.9	5.6	11.3
UT-2	10.2	8.7	8.0	7.2	8.2	-7.9	20.6	-28.4	-11.4	12.5	-23.9	13.6	2.5	11.1
UT-3	9.9	10.3	11.6	12.7	17.3	12.4	26.0	-13.6	9.5	20.2	-10.7	36.4	12.0	24.4
Rocky Mountain total or average	664.7	769.6	1,162.8	1,575.5	1,939.9	51.1	26.9	24.2	35.5	19.2	16.3	23.1	7.2	15.9
Interior:														
AR-1	186.2	169.0	155.1	183.4	228.9	-8.3	14.1	-22.4	18.3	10.3	8.0	24.8	3.2	21.6
IL-1	630.8	673.7	714.0	748.2	747.7	6.0	11.7	-5.7	4.8	8.1	-3.3	-.1	2.3	-2.4
IL-2	500.0	557.3	683.3	794.7	848.4	22.6	15.8	6.9	16.3	11.6	4.7	6.8	5.0	1.8
IL-3	548.6	561.4	590.6	608.6	618.7	5.2	10.8	-5.6	3.0	6.7	-3.7	1.6	1.4	.2
IL-4	197.8	195.4	207.3	211.4	210.7	6.1	11.1	-4.9	2.0	5.9	-3.9	-.4	2.0	-2.4
IL-5	462.7	530.1	631.6	703.2	694.4	19.1	16.7	2.4	11.3	11.0	.3	-1.2	3.4	-4.6
IL-6	357.0	337.6	300.6	291.2	299.2	-11.0	6.3	-17.3	-3.1	1.5	-4.6	2.8	nc	2.8
IN-1	57.0	532.3	51.2	49.6	50.5	-3.8	7.6	-11.4	-3.0	3.6	-6.6	1.7	1.1	.6
IN-2	164.1	164.5	165.8	170.5	167.6	.8	8.3	-7.5	2.9	4.3	-1.4	-1.7	1.3	-3.0
IN-3	385.4	413.5	417.2	434.4	435.0	.9	13.7	-12.8	4.1	7.7	-3.6	-.1	1.8	-1.9
IA-1	126.9	121.9	117.0	110.2	108.5	-4.0	10.0	-14.0	-5.8	3.9	-9.7	-1.6	.3	-1.9
IA-2	725.5	772.9	838.6	894.4	920.8	8.5	13.8	-5.3	6.7	9.5	-2.8	2.9	2.7	.2
KS-1	97.5	92.8	95.5	96.0	96.1	2.9	10.4	-7.5	.5	5.6	-5.1	.1	1.7	1.8
KS-2	36.0	32.7	32.4	33.3	33.7	.9	7.0	-7.9	2.9	2.8	.1	1.0	0.7	.3
KS-3	145.1	131.5	121.5	117.4	115.7	-7.6	6.2	-13.7	-3.4	-.9	-4.3	-1.4	2.2	-.8
KY-1	325.5	317.5	330.6	345.0	376.0	4.1	13.9	-9.8	4.3	8.4	-4.1	9.0	3.6	5.4
MO-1	138.2	120.8	106.2	101.8	102.4	-12.1	4.6	-16.8	-4.1	.1	-4.0	.5	-.7	1.2
MO-2	153.7	155.2	192.4	228.4	240.2	24.0	11.1	12.9	18.7	8.2	10.5	5.1	3.2	1.9
MO-3	214.8	214.0	213.9	235.1	245.7	-.1	7.3	-7.3	9.9	4.9	5.0	4.5	1.5	3.0
MO-4	109.9	102.1	121.4	133.9	145.4	18.9	7.5	11.4	10.2	5.4	4.9	8.6	2.8	5.8
MO-5	160.9	152.0	143.2	141.1	147.6	-5.8	5.3	-11.1	-1.5	1.2	-2.7	4.6	-.1	4.5

Continued

Appendix table 10–Population trends in Coal Production Areas (CPA's), 1940-75–Continued

Region, State, and CPA	Total population					Change, 1950-60			Change, 1960-70			Change, 1970-75		
	1940	1950	1960	1970	1975	Total	Natural	Net migration	Total	Natural	Net migration	Total	Natural	Net migration
	Thousands					Percent								
Interior–Continued:														
OK-1	428.9	463.9	532.4	594.8	625.4	14.8	15.6	–0.8	11.7	9.6	2.2	5.1	3.2	1.9
OK-2	86.3	68.4	56.2	65.1	71.2	–17.7	10.6	–28.4	15.8	7.8	7.9	9.4	3.6	6.8
OK-3	92.9	73.0	58.0	62.6	63.7	–20.6	9.6	–30.2	8.0	4.1	3.8	1.7	.9	0.8
Interior total or average	6,332.5	6,474.7	6,876.1	7,354.6	7,593.5	6.2	12.1	–5.9	7.0	7.7	–.7	3.2	2.5	.7
Eastern:														
AL-1	887.3	1,000.8	1,057.6	1,100.4	1,164.8	5.7	16.8	–11.1	4.0	9.9	–5.9	5.8	3.4	2.4
KY-2	88.1	89.2	93.5	96.3	98.2	4.8	17.7	–12.9	2.9	11.2	–8.2	2.0	3.2	–1.2
KY-3	315.4	281.0	243.2	234.1	258.9	–13.5	17.6	–31.1	–3.7	12.4	–16.1	10.6	3.9	6.7
KY-4	206.7	206.2	167.6	144.2	163.1	–18.7	21.0	–39.7	–14.0	13.6	–27.6	13.1	5.3	7.8
KY-5	220.1	213.4	158.2	129.9	141.5	–25.9	18.7	–44.6	–17.8	12.7	–30.5	8.9	5.2	3.7
KY-6	70.7	43.7	36.0	35.0	38.5	–17.6	17.4	–35.0	–2.9	12.1	–15.0	10.0	3.4	6.6
MD-1	109.0	110.8	104.6	105.5	107.1	–5.6	9.7	–15.4	.9	6.7	–5.8	1.5	1.9	–.4
OH-1	1,122.9	1,198.3	1,336.7	1,379.2	1,417.4	11.5	14.4	–2.8	3.2	8.1	–4.9	2.8	2.9	–.1
OH-2	72.4	69.0	75.4	80.0	84.1	9.3	10.7	–1.4	6.0	6.9	–.8	5.2	2.8	2.4
OH-3	67.7	65.4	67.2	75.2	73.7	2.8	9.7	–7.0	12.0	8.2	3.8	–2.0	3.8	–5.8
OH-4	220.9	218.7	227.6	215.5	229.8	4.1	13.6	–9.5	–5.3	7.2	–12.5	6.6	2.6	4.0
PA-1	2,173.3	2,325.2	2,512.6	2,485.2	2,409.8	8.1	13.5	–5.4	–1.1	6.6	–7.7	–3.0	1.1	–4.1
PA-2	1,746.4	1,746.4	1,769.6	1,778.5	1,822.3	1.3	12.6	–11.2	.5	7.4	–6.9	2.5	3.1	–.6
TN-1	196.2	239.8	227.4	225.0	243.7	–5.2	18.1	–23.2	–1.1	11.3	–12.4	8.3	3.5	4.8
TN-2	287.3	321.7	348.5	373.0	398.6	8.3	17.0	–8.7	7.0	10.5	–3.5	6.8	3.9	2.9
VA-1	239.7	253.6	228.2	197.1	212.0	–10.0	18.6	–28.6	–13.6	9.8	–23.4	7.5	1.9	5.6
WV-1	170.4	169.8	175.0	171.2	171.6	3.0	13.0	–9.9	–2.2	6.8	–9.0	.2	2.2	–2.0
WV-2	389.8	397.8	355.6	349.6	367.8	–10.6	10.9	–21.5	–1.7	6.3	–7.9	5.2	2.1	3.1
WV-3	44.2	41.7	38.4	39.2	41.0	–7.9	11.1	–19.0	2.0	9.5	–7.6	4.7	2.7	2.0
WV-4	85.0	74.4	60.6	51.4	53.5	–18.5	12.0	–30.5	–15.1	7.2	–22.4	4.0	1.5	2.5

See footnotes at end of table.

Continued–

Appendix table 10–Population trends in Coal Production Areas (CPA's), 1940-75–Continued

Region, State, and CPA	Total population					Change, 1950-60			Change, 1960-70			Change, 1970-75		
	1940	1950	1960	1970	1975	Total	Natural	Net migration	Total	Natural	Net migration	Total	Natural	Net migration
	Thousands					*Percent*								
Eastern–Continued:														
WV-5	545.6	626.3	610.4	558.4	562.9	-2.5	18.4	-20.9	-8.5	9.6	-18.1	0.8	3.5	-2.7
WV-6	456.6	488.8	399.6	340.1	358.4	-18.3	16.5	-34.8	-14.9	7.2	-22.1	5.4	3.1	2.3
Eastern total or average	9,698.5	10,182.0	10,293.7	10,164.0	10,418.7	1.1	14.7	-13.6	-1.3	8.1	-9.4	2.5	2.6	-.1
Gulf:														
AL-2	253.0	226.0	211.0	222.0	216.0	-6.5	19.0	-25.5	5.3	14.2	-8.9	-3.0	5.6	-8.6
AR-2	231.0	275.0	322.0	374.0	419.0	17.2	18.8	-1.6	15.9	13.4	2.5	12.1	5.4	6.7
TX-1	758.0	893.0	1,040.0	1,196.0	1,305.0	16.3	20.9	-4.6	15.0	14.3	.7	9.1	5.5	3.6
TX-2	223.0	204.0	197.0	199.0	206.0	-3.6	15.2	-18.8	1.0	7.6	-6.6	3.3	2.0	1.3
TX-3	266.0	239.0	231.0	263.0	300.0	-3.0	13.4	-16.4	13.7	8.4	5.3	14.0	2.8	11.2
Gulf, total or average	1,732.0	1,837.0	2,001.0	2,254.0	2,445.0	8.9	18.8	-9.8	12.6	12.8	-.2	8.5	4.9	3.6
Pacific:														
AK-1	[1]	1.4	2.1	[2]3.5	4.2	49.0	54.5	-5.5	61.8	40.4	21.4	21.7	5.9	15.8
AK-2	[1]	21.5	47.5	54.8	59.0	120.5	59.2	61.3	15.3	29.1	-13.8	7.7	11.1	-3.4
AK-3	[1]	3.6	5.2	6.5	10.6	44.4	25.5	18.9	25.5	17.4	8.1	62.8	7.5	55.3
AK-4	[1]	5.1	9.1	16.6	18.5	79.2	31.8	47.4	83.2	16.6	66.7	11.5	7.3	4.2
WA-1	60.4	66.7	70.3	82.0	90.6	5.4	11.7	-6.3	16.5	5.7	10.8	10.6	3.0	7.6
WA-2	707.3	1,031.1	1,277.1	1,592.7	1,584.4	23.9	15.6	8.3	24.7	11.9	12.8	-.5	3.2	-3.7
WA-3	78.7	88.6	96.9	122.4	142.1	9.3	12.6	-3.3	26.3	9.2	17.0	16.1	3.5	12.6
Pacific total or average	[1]	1,218.1	1,508.2	1,878.4	1,909.4	23.8	16.0	7.8	24.5	12.1	12.4	1.6	3.4	-1.8

nc = No change.

[1] Not available.

[2] Revised data from *Current Population Reports*, Series P-25, No. 638 (*87*). A portion of the 1960-70 change was due to a change in Census District boundaries.

*U.S. GOVERNMENT PRINTING OFFICE : 1981 O-340-932/ESS-151